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TERMINAL FORECAST REFERENCE NOTEBOOK (TFRN) FOR GEORGE AFB, CAL--ETC(U)

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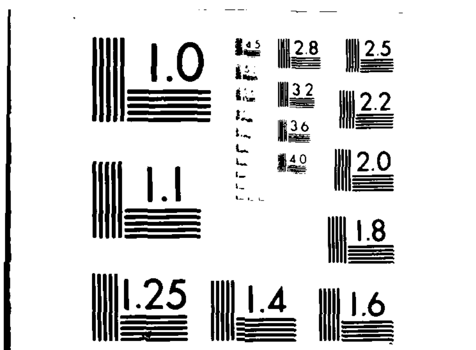


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Calif. Detachment 12

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George AFB, Calif.

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# TERMINAL FORECAST REFERENCE NOTEBOOK

FOR

GEORGE AFB CA

DETACHMENT 12, 25WS

GEORGE AFB CA 92392

4 September 1980

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Robert E Black

ROBERT E. BLACK, Lt Col, USAF
Operations Officer

FOR THE COMMANDER

Robert E Black

ROBERT E. BLACK, Lt Col, USAF
Operations Officer

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# REPORT DOCUMENTATION PAGE

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Cuddeback Range

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This terminal forecast reference notebook is for George AFB CA. It describes the following topics concerning forecasting at George AFB: location, topography, and local effects; impact of weather on supported units; synoptic meteorology; climatic aids; operationally significant forecast problems; rules of thumb; special synoptic study; and approved forecast studies. A forecasting guide for Cuddeback Range is also included.

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# Chapter 1

## Location, Topography and Local Effects

### 1-1 Station Location

George Air Force Base is located 6 miles northwest of Victorville, CA at 34°35' N and 117° 23' W and has a field elevation of 2875' MSL. The base lies in the southern portion of the Mojave Desert which gradually (.5% grade) slopes up towards the south-southwest. The Mojave River flows northward from its source in the San Bernardino Mountains to the southeast and passes one mile east of the base before returning to its underground riverbed.

The area north and east of the station is dominated by ragged hills and valleys typical of the Great Basin area. Southeast are the San Bernardino Mountains (highest peak, Mt. Gorgonio, elev. 11,485' MSL) which run southeast through northwest. Twenty miles south of the base is Cajon Pass (elev. 4,300' MSL) which separates the San Bernardino range from the San Gabriel Mountains (highest peak, Mt San Antonio, elev. 10,080' MSL) to the southwest of George. Sixty miles west of George is New Hall Pass (elev. 3,000' MSL) separating the San Gabriels from the foothills of the Sierra Nevada range to the north. Seventy miles west-northwest is Tehachapi Pass (elev. 3,800' MSL), the gateway to the lower San Joaquin Valley.

Normally dry lake beds, Mirage Lake, 12 miles west-northwest, and Rabbit Lake, 20 miles east-southeast at the end of Lucerne Valley, both become excellent moisture sources for a period after heavy rains. The California Aqueduct runs northwest through Hesperia, then towards Palmdale but is not considered a substantial moisture source except in periods of air stagnation (fig 1-1).

Scrub brush, cacti, Joshua trees and some larger Cottonwood and Willows along the river bed, are sufficient to keep the sand in place under most conditions.

### 1-2 Topographical Effects

The Mojave Desert is the result of the surrounding topography. Weather records from desert stations are very scanty and widely spaced and we really do not know just how topography affects specific weather phenomena (fig 1-2).

Winds are a year round problem to accurately forecast. Numerous passes in the mountain ranges can magnify speeds, give strong wind shear and cause low level jets that bounce across the desert floor giving 20-30knot speed differences within a few miles.

The mountains block the maritime inversion for the most part but on occasion it will extend over to us, capping pollution pouring through Cajon Pass.

Frontal systems approaching from the northwest seldom have ceilings lower than the mountains in that direction (elev 7,000').

Thunderstorms and winter stratocumulus form over the mountains south and just to the east of the station where the Cajon Pass winds lift the zonal flow. Clouds will build along this line

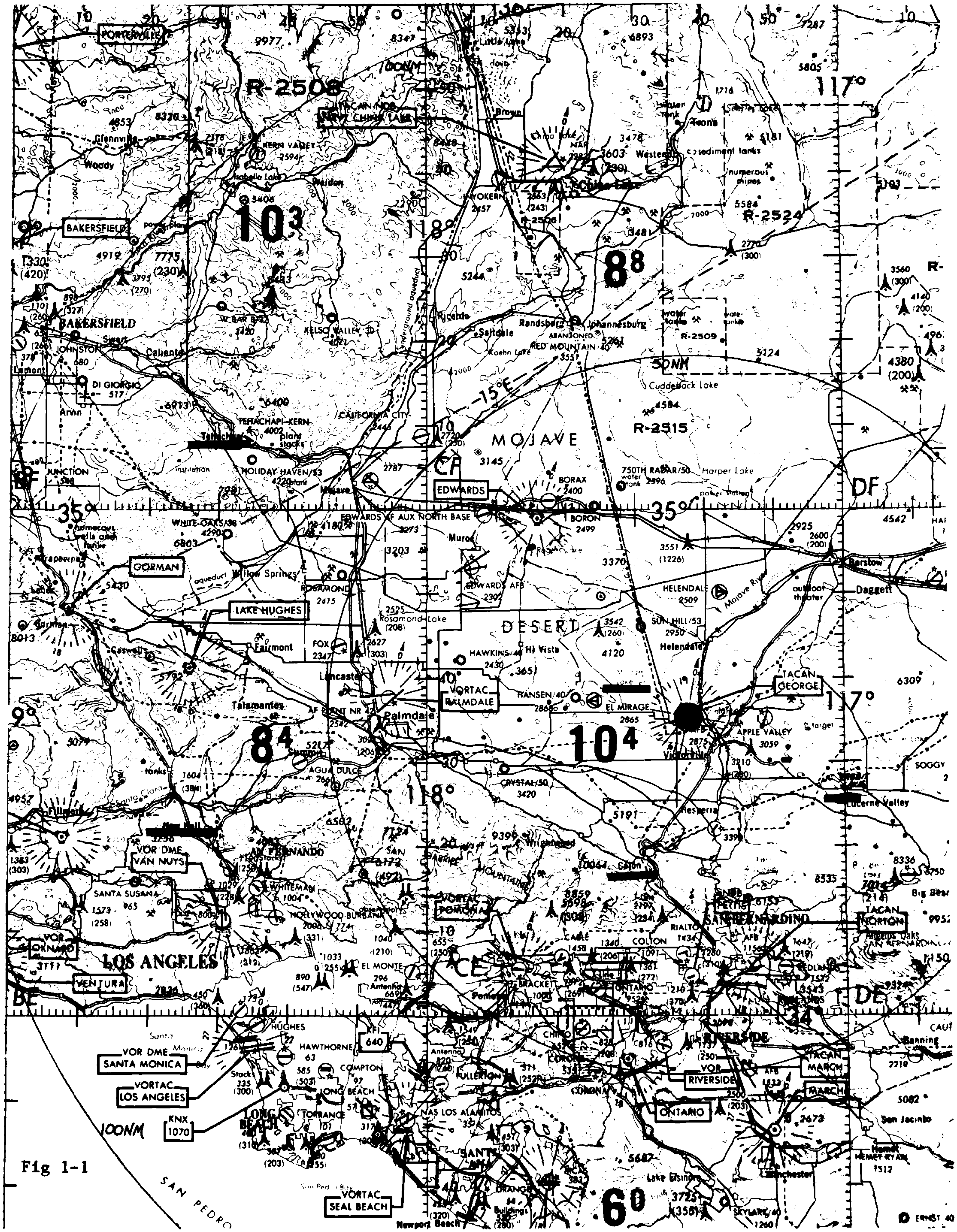

PORTERVILLE
R-2508
NAVY CHINA LAKE
BAKERSFIELD
BAKERSFIELD
117°
118°
R-2524
R-2506
R-2509
R-2515
50NM
100NM
MOJAVE
DESERT
EDWARDS
EDWARDS AFB
EDWARDS AF AUX NORTH BASE
GORMAN
LAKE HUGHES
VORTAC PALMDALE
TACAN GEORGE
35°
DF
CF
CE
BE
DE
Palmdale
Lancaster
Rosamond Lake
CALIFORNIA CITY
Randsburg
Johannesburg
RED MOUNTAIN
Cuddeback Lake
Harper Lake
Barstow
Daggett
HELENDALE
Victorville
APPLE VALLEY
Hesperia
Wrightwood
VOR DME VAN NUYS
SAN FERNANDO
WHITEMAN
HOLLYWOOD BURBANK
VORTAC POMONA
LOS ANGELES
VOR OXNARD
VENTURA
SANTA SUSANA
EL MONTE
SAN BERNARDINO
TACAN NORTON
REDLANDS
RIVERSIDE
VOR RIVERSIDE
TACAN MARCH
MARCH
ONTARIO
VOR DME SANTA MONICA
VORTAC LOS ANGELES
KNX 1070
HAWTHORNE
COMPTON
LONG BEACH
TORRANCE
VORTAC SEAL BEACH
Newport Beach
NAS LOS ALAMITOS
FULLERTON
CORONA
CHINO
Lake Elsinore
Banning
San Jacinto
SKYLARK
SAN PEDRO
10³
8⁸
8⁴
10⁴
6⁰

Fig 1-1

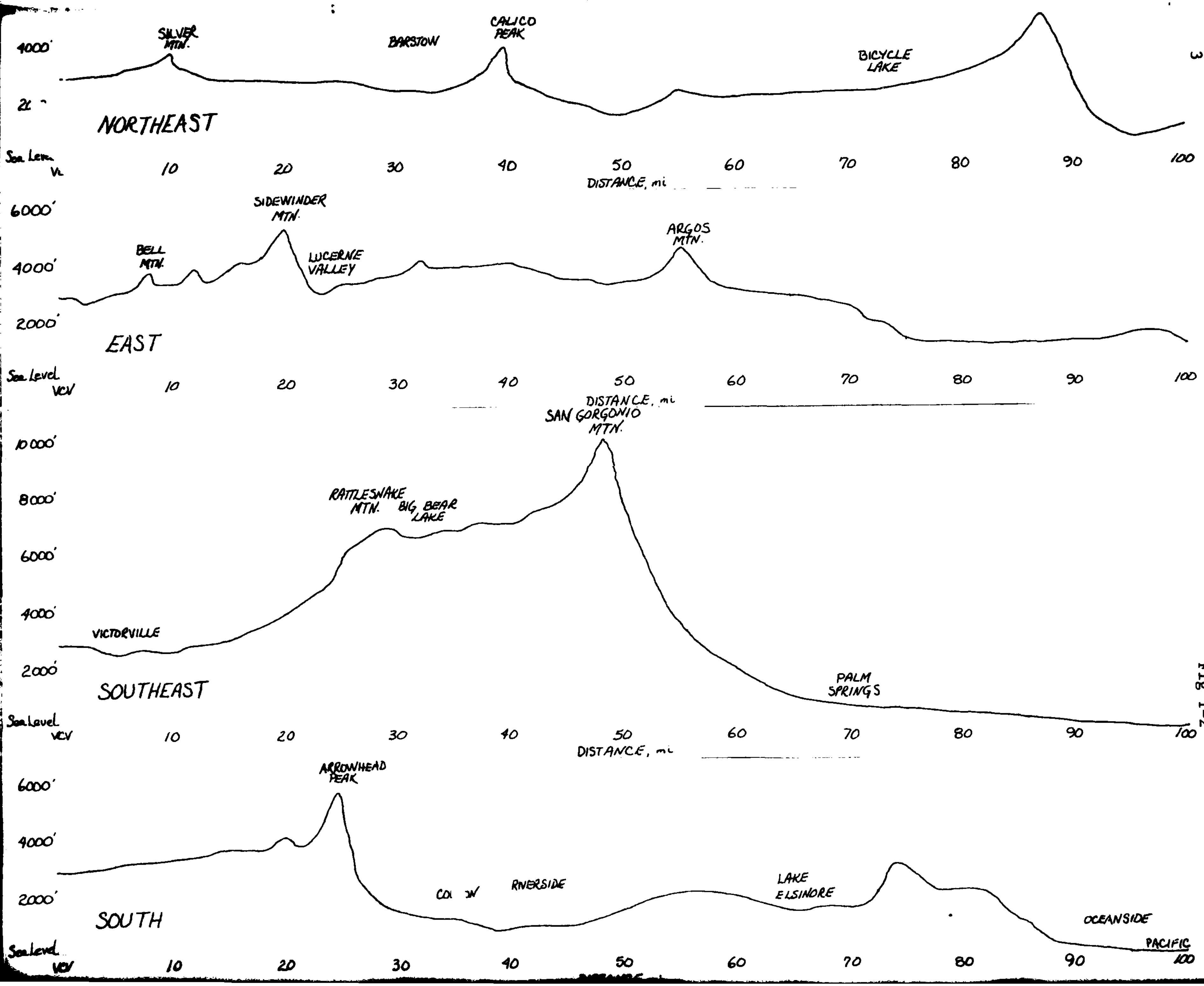
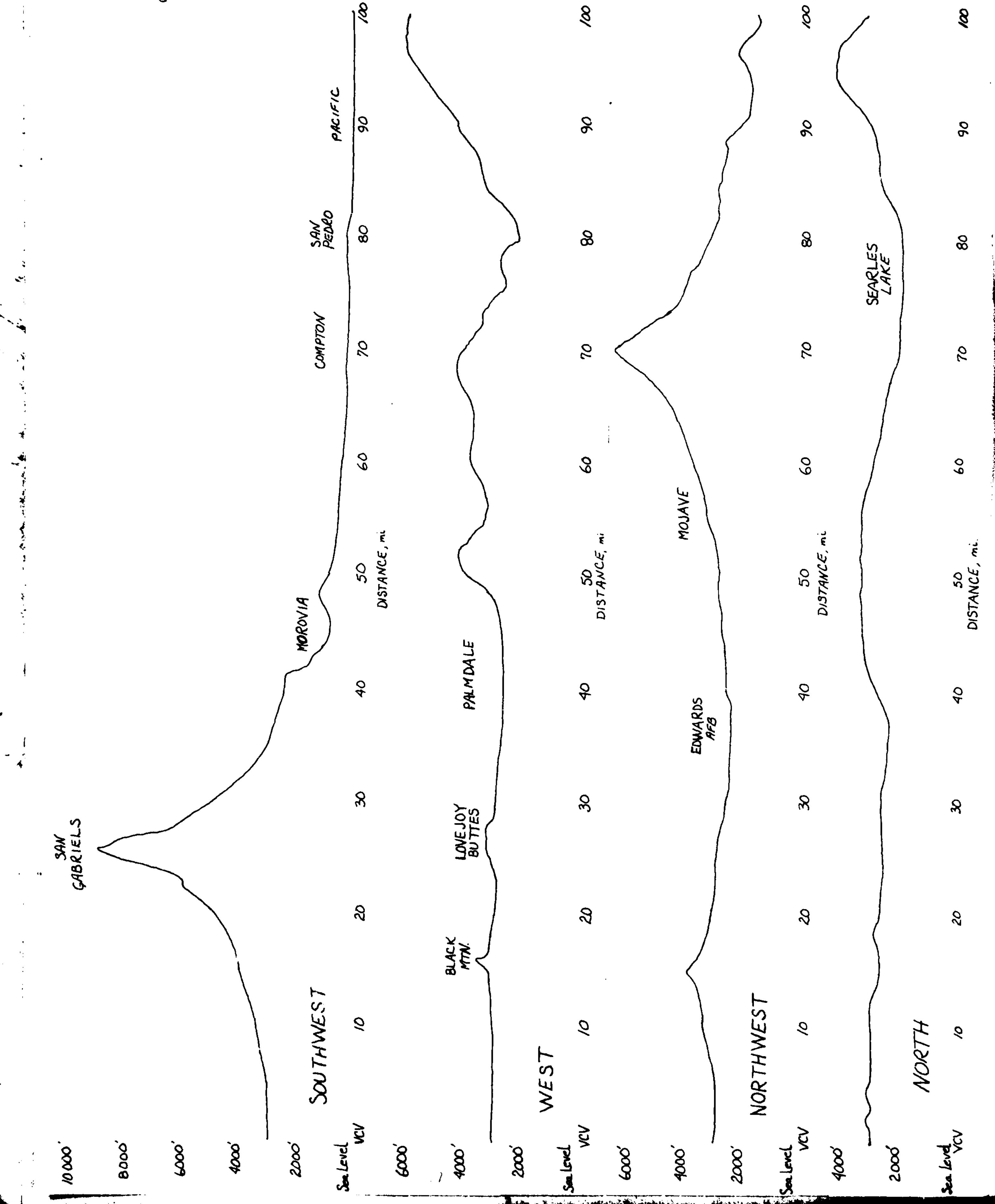

SILVER MTN.
BARSTOW
CALICO PEAK
BICYCLE LAKE
4000'
NORTHEAST
Sea Level
10
20
30
40
50
60
70
80
90
100
DISTANCE, mi
SIDEWINDER MTN.
BELL MTN.
LUCERNE VALLEY
ARGOS MTN.
6000'
4000'
2000'
EAST
Sea Level
DISTANCE, mi
SAN GORGONIO MTN.
RATTLESNAKE MTN.
BIG BEAR LAKE
VICTORVILLE
PALM SPRINGS
10 000'
8000'
6000'
4000'
2000'
SOUTHEAST
Sea Level
DISTANCE, mi
ARROWHEAD PEAK
RIVERSIDE
LAKE ELSINORE
OCEANSIDE
PACIFIC
SOUTH

Fig 1-2

Fig 1-2 Cont


SOUTHWEST
SAN GABRIELS
MOROVIA
COMPTON
SAN PEDRO
PACIFIC
WEST
BLACK MTN.
LOVEJOY BUTTES
PALMDALE
NORTHWEST
EDWARDS AFB
MOJAVE
NORTH
SEARLES LAKE
DISTANCE, mi
VCV
Sea Level
2000'
4000'
6000'
8000'
10000'
10
20
30
40
50
60
70
80
90
100

until they intensify sufficiently to move over us.

These and other phenomena will be expanded on in the following chapters.

## 1-3 Base Weather Station and Meteorological Sensors.

The weather station is located behind the Control Tower in the Base Operations building. Observations are taken from the southwest corner of the building. A stairtower there gives a vantage point that has only about 15% of the horizon blocked by hangers, trees, etc. Visibility checkpoints are very limited between 1 and 7 miles (fig 1-3).

Installed Equipment

- GMQ-20 Wind Set with 3 transmitters
- GMQ-10 Transmissometer transmitter and detector
- GMQ-13 Rotating Beam Ceilometer transmitter and detector
- TMQ-11 Temperature/Dew Point transmitter

Base Weather Station

- RO362 Wind recorder
- ID815A Wind indicator
- ML512 Mecurial Barometer
- ML102 Aneroid Barometer
- ML562A Barograph
- GMQ-10 Transmissometer indicator
- GMQ-13 Rotating Beam Ceilometer indicator
- TMQ-11 Temperature/Dew Point indicator
- ML47 Rain Guage
- Active runway indicator

Tower

- ID815 Wind indicator
- ID373 Wind indicator

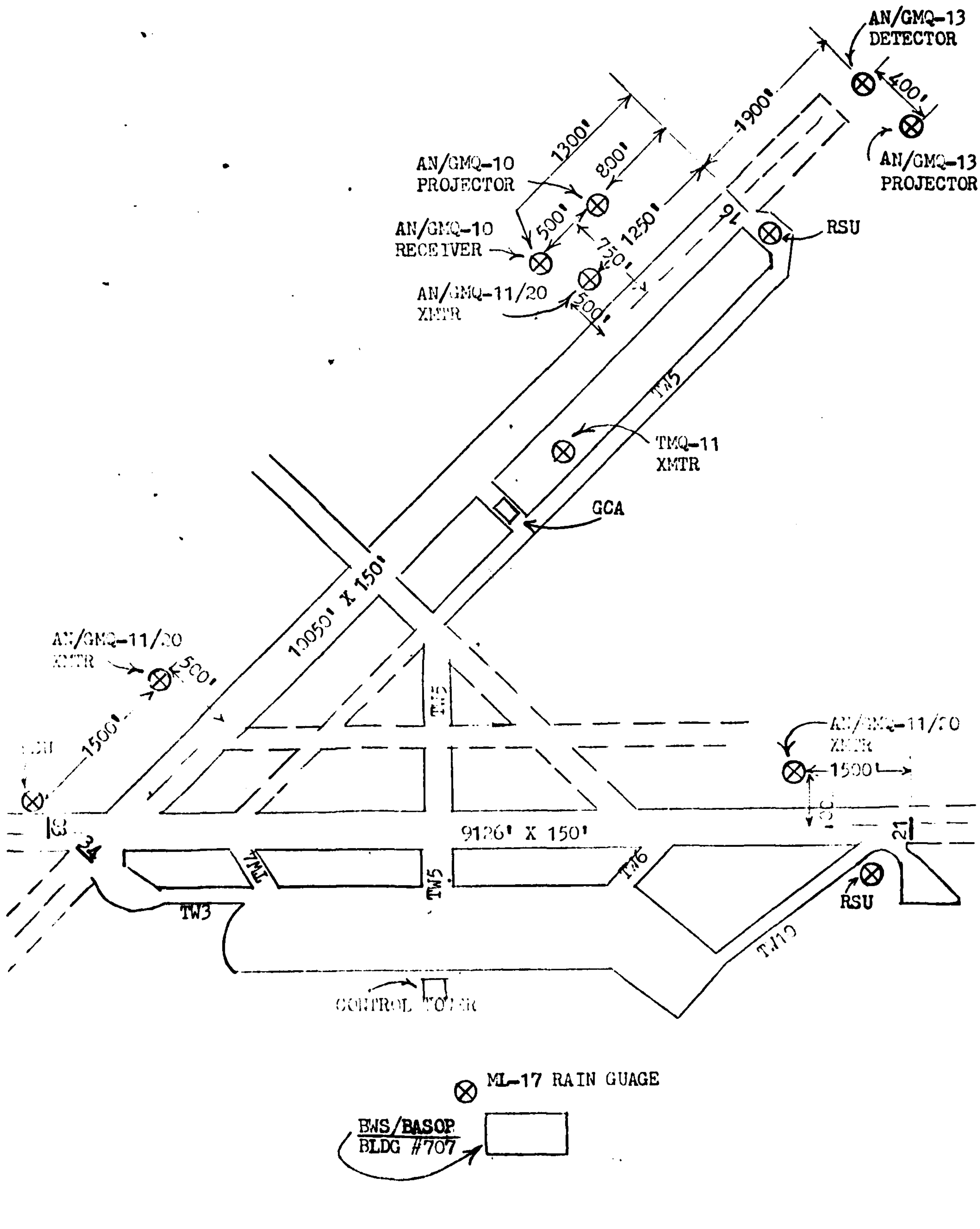
Ground Control Approach

- ID815 4 Wind Indicators

## 1-4 Pollution Sources and Effects

The primary source for pollution is fires. Concentrated in the late summer and fall, these fires in the surrounding hills add considerable smoke to the air, reducing visibilities to 1-3 miles in places, especially when capped by an inversion.

Los Angeles pollution is often forced up through the Cajon Pass. This is a year round phenomenon. George AFB visibility seldom drops below 5 miles because the pollution tends to


AN/GMQ-13
DETECTOR
400'
AN/GMQ-13
PROJECTOR
1900'
1300'
800'
AN/GMQ-10
PROJECTOR
AN/GMQ-10
RECEIVER
500'
750'
1250'
16
RSU
AN/GMQ-11/20
XMTR
500'
TW5
TMQ-11
XMTR
GCA
10050' X 150'
AN/GMQ-11/20
XMTR
500'
1500'
TW5
AN/GMQ-11/20
XMTR
1500
3
34
9126' X 150'
21
TW4
TW5
TW6
TW3
RSU
TW10
CONTROL TOWER
ML-17 RAIN GUAGE
BWS/BASOP
BLDG #707

concentrate in the Lucerne Valley and along the foothills of the mountains.

Two local cement plants, 4 miles southeast and 3 miles east northeast, do not really effect airbase visibility but during early morning hours when strong temperature inversions are present, visibilities in the valley to the east can be reduce to 3-5 miles.

# CHAPTER 2

## IMPACT OF WEATHER ON SUPPORTED UNITS

### 2-1 Units/Activities Supported

Tactical Training George is the home base for the 35 Tactical Fighter Wing. The 35 TFW is one of three wings, world wide, whose primary mission is that of Wild Weasel. Wild Weasel Aircrews are trained to, in time of combat, seek out and destroy enemy surface to air missile sites. This makes them the most proficient flyers in the Air Force in the firing of Air to Ground missiles. All other units on the base are here to support them. A secondary mission of the 35 TFW is to train student aircrews to fly the F-4E/G. They meet this end by attending a 5-8 month RTU (Recycle Training Unit) program. They learn the basics of dive bombing, dog fighting and air to air refueling. The training program is rigorous. Students fly up to twice daily. They also attend daily academic classes. Consider the RTU the fighter pilot Tech School. The table below outlines the major units supported on the base.

Table 2-1 Organization

TACTICAL TRAINING GEORGE

HOSPITAL

35TH TACTICAL FIGHTER WING

| DEPUTY COMMANDER FOR OPERATIONS | COMBAT SUPPORT GROUP | MAINTENANCE |
|---|---|---|
| 20 TFTS / German AF F4E | Base Ops | |
| 21 TFTS / F4E | Civil Engineering | |
| 39 TFS / F4G | | |
| 561 TFS / F4G | | |
| 562 TFS / F4E | | |
| 563 TFS / F4G | | |
| 84 FIS / F106 | | |
| Helocopter Ops UH 1 P | | |

2-2. 35 TFW MAINTENANCE

Job Control receives our Met Watch Advisories and Weather Warnings through Base Ops. They take actions base on Severe Weather Phases as listed in AFR 355-1, TAC Sup 1. These Phases are:

Phase I: Routine operations for which no natural disaster producing phenomena are occuring or expected to occur (within the state of science capability of predicting such phenomena). This means that weather warning criteria are not expected to occur within the established desired lead time. Weather warning lead times are designed to provide agencies sufficient time to accomplish protective measures. Under Phase I, non-destructive weather conditions (such as winds up to 34 knots, rain, snow, and thunderstorms) are to be expected.

Phase II: Destructive phenomena are occuring or expected to occur which require limited protective measures to be taken and expeditiously accomplished. Actions for unpredicted natural phenomena such as fire or earthquake will be dictated by the situation when it occurs. Weather warning criteria under Phase II are as follows:

a. Winds with maximum gusts 35 knots or greater. Less than 50 knots.

b. Hail: ½" or greater but less than 3/4".

c. Snow: 2" or more within 12 hours.

d. Heavy Rain: 2" or more within 12 hours.

e. Freezing Precipitation.

Phase III: Severe destruction phenomena are occuring or expected to occur that require extensive protective measures be immediately accomplished; evacuation of aircraft or other valuable resources may be necessary. Actions for unpredicted phenomena such as fire or earthquake will be dependent upon the situation when it occurs. Weather Warning criteria under Phase III are as follows:

a. Winds with maximum gusts 50 knots or greater.

b. Hail 3/4" or greater.

c. Tornadoes.

Table .-2. F4 E/G Fighter Squadrons of the 35 TFW

| WEATHER ELEMENT | THRESHHOLD VALUE | LEAD TIME | IMPACT/ACTION | COST |
|---|---|---|---|---|
| WIND | 25 KT Cross | 15 Min | -FLYING STOPS | -LOST MISSION |
| | | | -AIRCRAFT ALOFT DIVERTED | |
| WIND | 15 KT Cross | 15 Min | -NO FORMATION TAKEOFFS | -MISSION IMPAIRMENT |
| | | | -NO DART TOW TAKEOFFS | |
| WIND | 10 KT Tail | 15 Min | -NO TAKEOFFS | -MISSION IMPAIRMENT |
| | | | -NO LANDINGS | -MOVE TO NEW RSU |
| | | | -RUNWAY CHANGE | -MOVE TO NEW QUICKCHECK |
| CIG/VSBY | 3000/5 | 1 Hr | -NO NIGHT JOINUPS UNDER CLOUDS | -MISSION IMPAIRMENT |
| | | | -NO NIGHT AGGR SORTIES | -MISSION LOSS |
| CIG/VSBY | 2000/3 | N/A | -NO DAY AGGI SORTIES | -MISSION LOSS |
| CIG/VSBY | 1500/5 | N/A | -NO DAY NUCLEAR SORTIES | -MISSION LOSS |
| CIG/VSBY | 1500/3 | N/A | -NO DAY JOINUPS UNDER CLOUDS | -MISSION IMPAIRMENT |
| | | | -NO PRACTICE OF AIRBORNE RADAR APPROACHES | |
| | | | -STUDENT FLYING STOPS | |
| CIG/VSBY | 500/½ | N/A | -FLYING STOPS | -MISSION LOSSES |
| CIG/VSBY | 100/½ | N/A | -AIRFIELD CLOSES | |
| TSTMS | Local Flying Area | 1 Hr | -FLIGHT TIME REDUCED | -SOF TAKES INTO ADVISEMENT |
| TSTMS | 5 NM Radius VCV | N/A | -FLIGHT TIME REDUCED | -SOF MADE AWARE |
| LIGHTENING | 5 NM Radius VCV | N/A | -RESTRICT FLYING | -DIVERT IF OVER FIELD |

Table 2-3. HELICOPTER OPS UH1 F

| WEATHER ELEMENT | THRESHOLD VALUE | LEAD TIME | IMPACT/ACTION | COST |
|---|---|---|---|---|
| WIND | 30 KTS | 1 HR | NO TAKEOFFS/LANDINGS | MISSION LOSS |
| | | | | COST TO FLY TO DIVERT BASE |
| WIND | 20 KT Gust Spread | 1 HR | NO TAKEOFFS/LANDINGS | |
| CIG/VSBY | 500'1½ | N/A | FLYING STOPS | |

Table 2-4. 84th Fighter Interceptor Squadron F106

| WEATHER ELEMENT | THRESHOLD VALUE | LEAD TIME | IMPACT/ACTION | COST |
|---|---|---|---|---|
| WIND | 20 Kt Cross | N/A | ALERT STATUS CHANGED | NONE |
| CIG VSBY | 300'1 | N/A | ALERT STATUS CHANGED | COST TO DIVERT |
| | | | DIVERT IF ALOFT | |
| LIGHTENING | 3NM Radius (VCV) | N/A | REFUELING WEAPONS LOADING CANCELLED | MISSION IMPAIRMENT |

Table 2-5. 35th TFW MAINTENANCE

| WEATHER ELEMENT | THRESHOLD VALUE | LEAD TIME | IMPACT/ACTION | COST |
|---|---|---|---|---|
| WIND | PHASE I<br>25-34 Knots | 1 Hr | -CLOSE CANOPIES<br>-SECURE AGE<br>-CLOSE RADOMES<br>-RESTRICT MAINTENANCE<br>-LIMIT SEAT INSTALLATIONS<br>-CLOSE HANGAR DOORS<br>-CEASE MUNITIONS LOADING<br>-HANGAR HELICOPTERS<br>-INSTALL INTAKE PLUGS | -MISSION IMPAIRMENT<br>-MANHOURS REQUIRED TO PERFORM EXTRA DUTIES |
| WIND | PHASE II<br>35-49 Knots | 1 Hr | -COMPLIANCE WITH ALL PHASE I ACTIONS<br>-DO NOT OPEN HANGAR DOORS EXCEPT TO STORE EQUIPMENT<br>-STORE AIRCRAFT BOARDING LADDERS<br>-PLACE FIRE BOTTLES ON SIDES<br>-REMOVE AIRCRAFT FROM JACKS<br>-RETRACT FLAPS AND SPEED BRAKES | |
| WIND | PHASE III<br>50 Knots or greater | 1 HR | -COMPLIANCE WITH ALL PHASE II ACTIONS<br>-LOCK ALL WING FOLDS DOWN<br>-PARK ALL AIRCRAFT INTO WIND | MISSION LOSS |

Table 2-5 Continued

| WEATHER ELEMENT | THRESHOLD VALUE | LEAD TIME | IMPACT/ACTION | COST |
|---|---|---|---|---|
| | | | -HANGAR AIRCRAFT WHERE POSSIBLE | |
| HAIL | Less than ½" | N/A | -COMPLIANCE WITH ALL PHASE I WIND ACTIONS | |
| HAIL | ½" but less than 3/4" | | -COMPLIANCE WITH ALL PHASE II WIND ACTIONS | |
| HAIL | 3/4" or greater | | -COMPLIANCE WITH ALL PHASE III WIND ACTIONS | |
| SNOW | 2" or more in 12 hours | | -COMPLIANCE WITH ALL PHASE II WIND ACTIONS | |
| RAIN | 2" or more in 12 hours | N/A | -COMPLIANCE WITH ALL PHASE II WIND ACTIONS | |
| FREEZING PRECIPITATION | ANY | N/A | -COMPLIANCE WITH ALL PHASE II WIND ACTIONS | MISSION LOSS |
| TORNADOES | N/A | N/A | -COMPLIANCE WITH ALL PHASE III WIND ACTIONS | |
| LIGHTENING | 3NM VCY | N/A | -CEASE MUNITIONS LOADING<br>-CEASE FUELING OPERATIONS | MISSION IMPAIRMENT |

| CODE | CRITERIA |
|---|---|
| 1T1 F-106 | 300/1 |
| 1T2 F-4 | 500/1½ |
| 1R1 Nuclear (Cudde) | 1500/5 - clouds no lower than 1000' above highest pattern flown |
| 1R2 Low Level Navigation Routes | 1500/5 |
| 1R3 Conventional (Cudde) | 3000/3 - clouds no lowere than 500' above highest pattern flown (3000-10,000') |
| 1R4 Tactical (Leach Lake) | 300/3 - clouds no lower than 500' above highest pattern flown (up to 10,000') |
| 1R5 F-4 Weasel Profile (TPH,ØL2) | 3000/3 |
| 1R6 Night(Cudde) | 3000/5 - clouds no lower than 500' above highest pattern flown |
| 1R7 Tactical (29 Palms) | 3500/5 - clouds no lower than 1000' above highest pattern flown (up to 10,000') |
| 1R8 Dart (Leach Lake) | 5 mi - no undercast - clouds no lower than 2000' above highest pattern flown (15,000-20,000') |
| 1RØ Transition (Areas I-IV) | 10,000 cloud free airspace |
| 1A1 Air-to-Air (29 Palms) | 10,000-15,000' cloud free airspace (may be undercast) |
| 1A2 Air Refueling (AR 625) | MDT-SVR ICG |
| 2T2 X-wnds (Dart Tow) | 15 kts |
| 2T3 X-wnds (F-4) | 25 kts |
| 2T5 X-wnds | 30 kts |
| 2T6 Winds | 35 kts |
| 2T7 Winds (Cudde) | 40 kts |
| 3T1 Precipitation | Any freezing or frozen |
| 3T2 Precipitation | Heavy rain or snow in next 12 hours |
| 3R1 Precipitation | 1" Hail |
| 4T1 Lightening. | Within 5 NM |

2-4. The F-4G Phantom is a two-place (pilot and electronic warfare officer), supersonic, long-range, all weather fighter-bomber aircraft built by the McDonnell Douglas Corporation at St. Louis, Missouri. All 116 of the G-models to be delivered to the Air Force beginning in April 1978 and scheduled to be completed during 1981, were slatted-wing, low flying time F-4E aircraft prior to conversion. The Ogden Air Logistics Center at Hill AFB, Ogden, Utah, is performing the $2.8 million modification on each aircraft at the rate of three F-4Gs per month.

The internally-mounted, 20 millimeter gatling gun of the F-4E has been removed in the F-4G modification. In its place and elsewhere in the aircraft has been mounted some very sophisticated electronic equipment. Major suppliers for the new electronics are IBM, receiver sets; Loral Electronics Systems, displays; Texas Insruments, homing and warning computers; General Electric, analysis receivers; and McDonnell-Douglas, software and support equipment.

The F-4G Wild Weasel is expected to greatly improve the Air Force's defense suppression capability. The Wild Weasel mission (named after an animal that feeds on vermin) is one of seeking out and electronically suppressing and/or destroying hostile radar-directed anti-aircraft artillery and surface-to-air missile sites. The F-4G can be armed with a variety of air-to-air and air-to-ground missiles, as well as conventional iron bombs including precision-guided and cluster munitions. Primary missile armament includes the Shrike (AGM-45), Standard (ARM (AGM-78), HARM (AGM-88), Maverick (AGM-65) and Rockeye cluster munitions.

The F-4G is powered by two General Electric J79-GE-17 turbojet engines with variable stators and variable afterburner. Lightweight (about 4,000 pounds each) for their power output, the J79s are rated at 17,900 pounds of thrust each in afterburner, and 11,870 pounds in full military power (without afterburner).

Fuel is carried internally in a fuselage tank made up of interconnecting cells, plus two internal wing tanks. About 1,900 gallons (12,300 pounds) of fuel can be carried internally. In addition, 1,340 gallons (8,700 pounds) of fuel can be carried externally in two 370 gallon wing tanks and a 600 gallon centerline fuselage tank. At normal cruise speeds (500-550 mph), the F-4G burns about 925 gallons (6,000 pounds) of fuel per hour. Use of afterburner increases fuel consumption by a factor of four.

The F-4G's wings can be folded, if required, for ease of aircraft storage and ground handling, a feature retained from the Phantom's original Navy design as a carrier-operated, fleet interceptor. A drag chute is deployed upon landing to significantly reduce the landing roll distance, and, for emergency use, an arresting hook can be extended to catch a runway barrier to quickly slow the aircraft.

DIMENSIONS & WEIGHT

Wing span - 38'5" (27'7" with wings folded)

Length - 63'

Height - 16'5"

Empty weight - about 32,5000 pounds

Maximum gross takeoff weight - 58,000 pounds

PERFORMANCE

Maximum speed - Mach 2.27 (approximately 1,600 mph) clean configuration

Normal cruise speeds - 500-550 mph

Takeoff speed - about 195 mph (varies with takeoff weight)

Landing speed - 163 to 193 mph (varies with landing weight and headwind)

Range with typical tactical load - 1,300 miles

Ceiling - above 60,000 feet

Time to climb to 15,000 meters (49,200 feet) - 1 min. 55 sec. (previously held world record)

New record set by F-15 Eagle at 1 min. 17 sec.

PRODUCTION COST

Basic F-4E - about $2.5 million

F-4G conversion cost - about $2.8 million per aircraft. Projected $325 million for 116 aircraft (includes support costs)

F-4E PHANTOM II

Built by McDonnell-Douglas in St. Louis, Missouri, the F-4E is a multi-role fighter capable of performing air superiority, close-air support and interdiction missions. More than 5,000 F-4 aircraft have been built since 1962, and it is still being turned out for the air forces of allied countries around the world.

Unlike earlier C and D-models of the Phantom, the F-4E has an internal 20mm gun mounted under the nose plus improvements in its fire control system, higher thrust engines, additional fuel capacity, and leading edge slats on the wings to improve maneuverability. It is flown by the 20 TFTS, 21 TFTS and 561 TFS here.

Extremely powerful, the F-4 held five time-to-climb records for 13 years before being broken by the F-15 Eagle in 1975. They were: 3,000 meters (9,850) in 34.5 seconds; 6,000 meters (19,685 feet) in 48.8 seconds; 9,000 meters (29,530 feet) in 61.7 seconds and 15,000 meters (49,213 feet) in 114.5 seconds. The F-15's new records are 27.6, 39.4, 48.9, 59.4 and 77 seconds respectively.

PERFORMANCE DATA

Maximum speed: More than 1,600 mph

Ceiling: Above 60,000 feet

Maximum range: More than 1,600 miles

Maximum weapons load: Four AIM-7 Sparrow and four AIM-9 Sidewinder missiles in air-to-air role; up to 16,000 pounds of external weapons and fuel stores in bombing role. One internal M61 20mm cannon.

Engines: Pratt & Whitney J-79-GE17 (two) afterburning turbojets; Each develops 17,900 pounds thrust in afterburner.

Maximum takeoff weight: 58,000 pounds

Dimensions: Length - 63' Height ' 16'5" Wingspan - 38'6"

Crew: Two - pilot and weapons system officer

2-5 F-106 Delta Dart

The F-106 Delta Dart is the most advanced all weather fighter interceptor in the Aerospace Defense Command (ADC). The F-106 is capable of air-to-air refueling. It is equipped with the Hughes MA-1 electronic guidance and fire control system which may be data linked to ADC's semiautomatic ground environment (SAGE) system. Utilizing this system, the F-106 may be flown automatically by the SAGE computer to within range of the intercept target where the pilot can automatically or manually fire the weapons on board. All F-106 armament is carried internally in the weapons bay.

Prime contractor: Convair Division General Dynamics Corporation

Power Plant: J75-P-17 (turbojet)

Manufacturer: Pratt & Whitney

Thrust: 24,500 pounds

Dimensions: Apan 38'1"; length 70'7"; height 20'3"

Speed: 1,400 m.p.h.

Ceiling: Above 50,000 ft

Range: Beyond 15,000 miles

Armament: Falcon and nuclear warhead Genie air-to-air weapons

Crew: One pilot

Maximum Gross Takeoff Weight: Over 35,000 pounds

2-6 UH-1P HELICOPTER

The two UH-1P helicopters are utilized in support of the Cuddeback Air-to-Ground Weapons Delivery Training Range in their primary mission role in the 35th Tactical Fighter Wing at George Air Force Base, California. Secondary and tertiary roles are search and rescue posture when the Wing is flying, and air evacuating medical patients to outlying hospitals for special treatment. Both UH-1Ps assigned to George operate from a readied alert status.

Prime Contractor: Bell Helicopter Corporation

Power Plant: T58-GE-3

Manufacturer: General Electric

Horsepower: 1325 Shaft

Dimensions: Length 57'; Height 12'7"; rotor diameter 48'

Speed: 120 Knots (136 m.p.h.)

Ceiling: 15,000 feet

Range: 230 miles

Load: 10 passengers or 2,000 pounds cargo

Crew: Maximum 4, two pilots, helicopter mechanic, and a medical technician

Maximum Gross Takeoff Weight: 9,000 pounds

## Chapter 3

## Synoptic Meteorology

3-1 **Major Controlling Features.** The High Desert of Southern California has two seasons, summer and a short winter, Dec-Mar. Primarily under modified mP airmasses, dry weather is predominent. Sporadic intrusions of cP air or strong advection of mT air over the mountains southwest brings winter cloudiness and precipitation. Transitional seasons are marked primarily by rapid temperature changes (change from heating to cooling days) and wind pattern changes. Winds are predominently southerly 40% of the time in summer and 20% of the time in winter.

3-2 **Summer Weather and Air Masses.** During the summer months the synoptic situation is dominated by a warm core thermal low from southern Nevada to southern Arizona. The weak thermally induced high aloft insures clear skies or at worst a little cirrus. On a meso scale, heating of the desert basin west to northwest of us generates its own thermal low giving us circulation from the south-southeast due to downslope motion of cooling air in the mountains southeast-southwest of the station. (fig 3-1)

A relatively strong high pressure system developes over the Pacific at around 35°N 150°W. Generally the trough aloft stays just off the California coast at 125°W but on occasion will deepen and move southeast enough to give us southwesterly winds aloft and some cirrus as the air moves up the slope of the trough. On rare occasions the trough moves inland far enough to give us northwesterly winds aloft, downslope motion, clear and somewhat cooler weather. It is very rare that jet streams penetrate this far south during the summer. (fig 3-2)

Occasionally a slow moving high will position itself over the south central United States giving us east - southeasterly winds up to 30,000 feet. Moisture advected from the Gulf of Mexico is trapped below 1-2,000 feet AFL in the basin around George by the same mountains which prevent coastal stratus from reaching us. When heated, this developes wide spread thunder[illegible]. The southeasterly winds must persist for at least two days before the moisture reaches this area. (fig 3-3)

3-3 **Transition Periods.** During the Apr-May and Oct-Nov transition periods heating days become cooling days and vice versa, within 30-45 day period. The westerly winds diminish at these times, becoming more predominent (15% of the time) during summer and winter seasons. On occasion a weak front may penetrate this far south and sub-jets may move over us, but most systems stop in mid California.

3-4 **Summer Visibility Obstructions.** Prevailing wind direction, height of the marine inversion and the temperature-dew point spread at George are the main parameters in the amount of pollution forced through the Cajon Pass from the Los Angeles basin. The inversion is higher in the latter

Fig 3-1



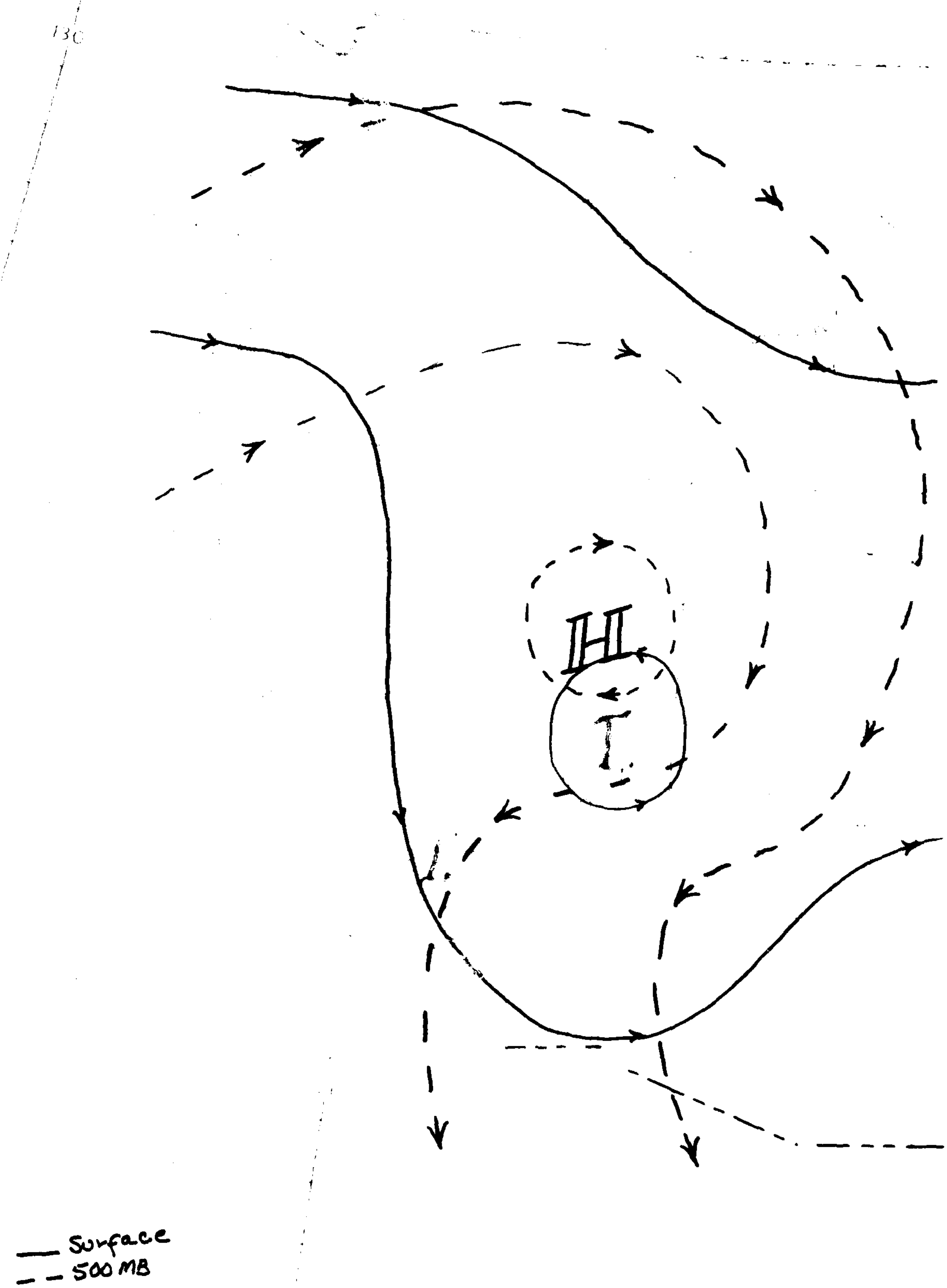
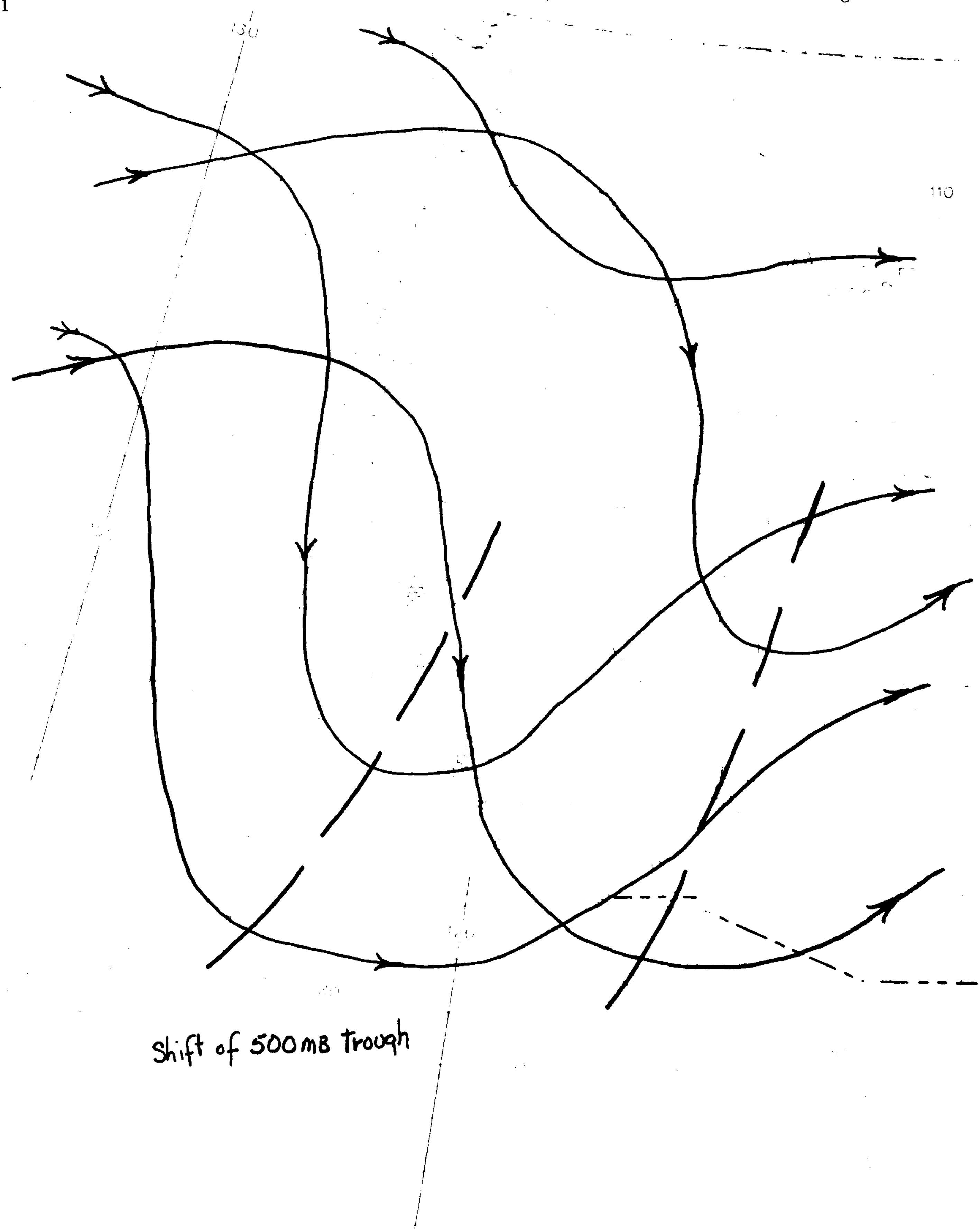
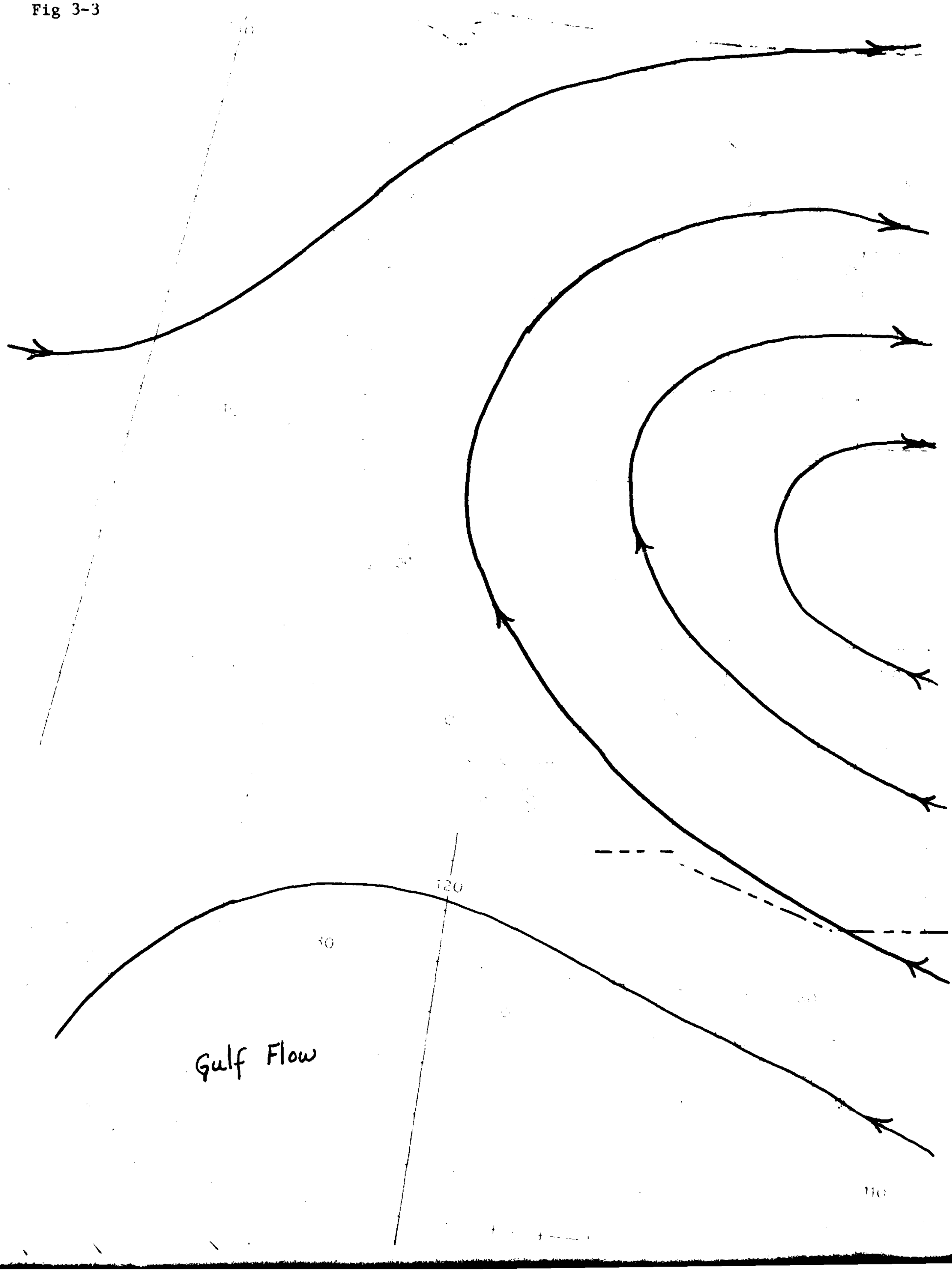


Fig 3-2




Shift of 500 MB Trough

Fig 3-3



half of summer allowing pollution trapped on the other side of the mountains to move through the pass, helped by the predominently southerly winds. The heaviest concentrations stay along the foothills near the pass but do spread through the desert basin after prolonged periods. Seldom will the visibility be restricted below 5-6 miles under these conditions.

Brush fires in the mountains southeast-southwest during the dry season can reduce the visibility considerably depending on the winds, size of the fire and how long the fire has been burning.

Smoke from the two cement plants northeast and southeast of George seldom affects airbase visibility but can reduce the visibility in the valley to 3-5 miles primarily in the morning hours when there is a strong inversion.

Fog is unknown during the summer because of the dryness and downslope winds.

3-5 Summer Hazardous Weather

a. Thunderstorms. Summer is the prime season for thunderstorms but they do occur all months of the year. The majority of activity is in the surrounding mountain areas and on occasion a storm will actually pass over the station. Thunderstorm bases are around 5,000 feet AGL with seldom heavier than moderate intensity showers. The primary hazard is wind gusts, up to 50 knots recorded. Normal periods of thunderstorms are short, occurring mostly in the late afternoon and evening. When large amounts of moisture are available (advection from the Gulf of Mexico) thunderstorm potential can linger for days with occurrences at any hour of the day. Frontal thunderstorms are are a rare event.

b. Gusty Winds. Strong (30 knots +) gusty winds in summer are usually associated with thunderstorms and on occasion with the tight pressure gradient of intense thermal lows.

A stream of air from the Cajon Pass is often at odds with the wind flow aloft and Low Level Wind Shear is common along the edge of this stream. The effect is usually very slight but on occasion considerable speed and direction change is observed by aircraft. The stream also whips across the desert which allows the shear area to move across the airfield complex in a random manner. Often, only one aircraft in a group, landing just minutes apart, is affected.

Low level wind jets, when present, tend to surface within two hours after the inversion breaks or the Cajon Pass flow subsides.

c. Hail. Hail is a rare event. It is usually limited to small hail, often as blow off ahead of the storm cell. The wet bulb zero point is usually too high to support hail.

d. Tornadoes. Only one tornado has ever been reported here, to the south of the station. Dust devils of considerable size are common due to the high winds. They appear dark (filled with dust) and extend several hundred feet above the surface. They are often mistaken for tornadoes

when there are low or undefined ceilings.

e. **Turbulence.** Turbulence is restricted primarily to the surrounding mountain areas. Except for helicopters, the aircraft assigned here are not particularly subject to turbulence. A variety of aircraft transit George every year and for several of these, turbulence is critical.

f. **Icing.** The dryness of the area limits icing to the mid to high altitudes most of the time. A shot of cold air at lower levels during the winter can produce light to moderate rime at worst, provided there is enough moisture present.

g. **Flooding.** Flooding of low areas of baked desert soil can occur with as little as ½" of rain. Summer thunderstorms produce patchy flooding, even flash flooding on occasion. Because the base sits high on a mesa, flooding is usually restricted to curbed roads. Runoff is slow because of the lack of slope and large areas drain down the roads which become the storm drains. Traffic is only slightly impeded.

h. **Tropical Storms/Depressions.** When a tropical system moves over us, the associated weather is similar to a strong San Diego low. Extensive cloud cover and precipitation continues well after the storm has moved inland, although if the storm center goes into Mexico rather than Southern California the precipitation is lessened considerably.

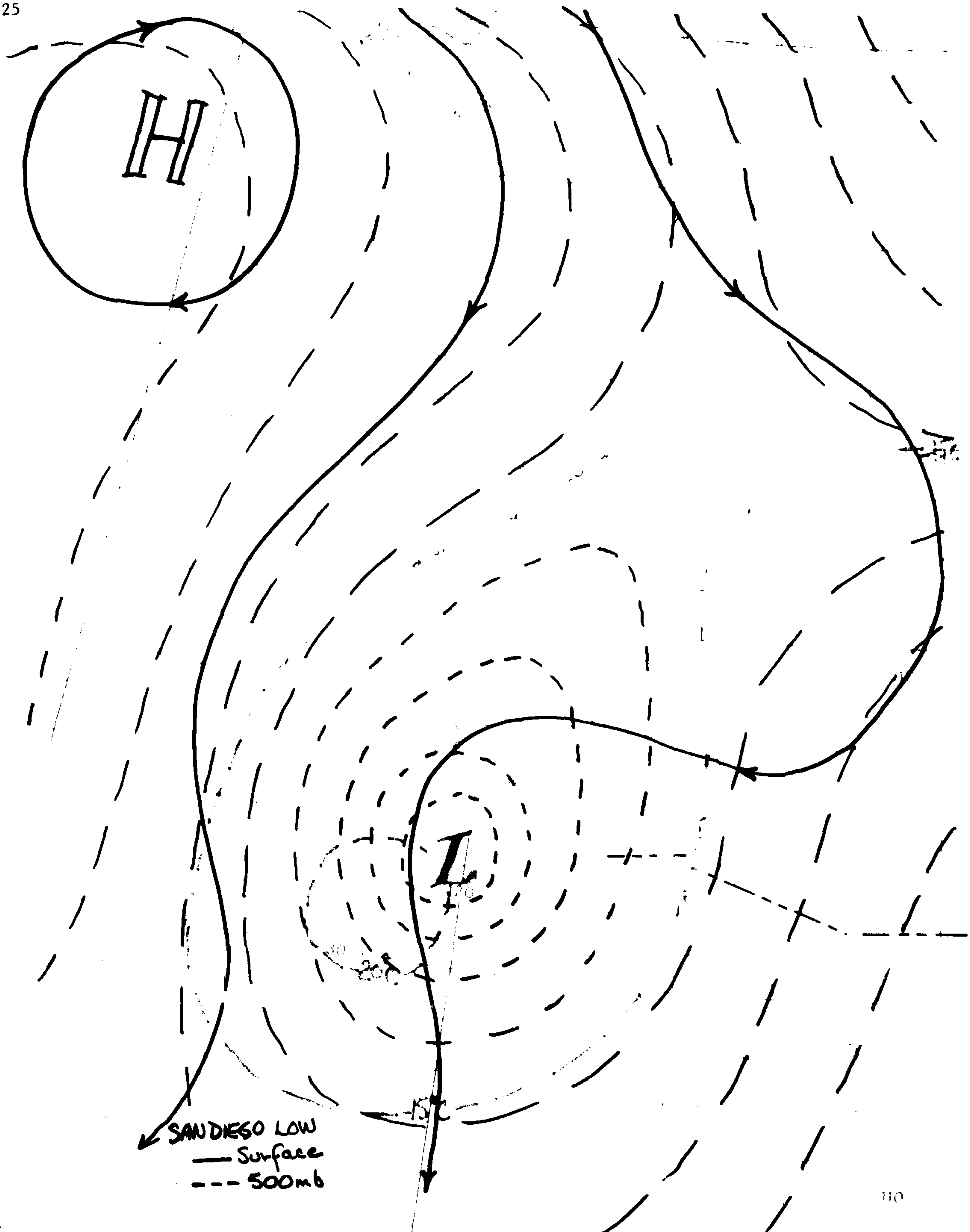
3-6 **Winter Weather and Air Masses.** Polar highs dominate the winter season. They are normally positioned several hundred miles north-northeast of the station. On occasion a low pressure center will pass within 200 miles of George.

Aloft, ridges and troughs produce low cloudiness associated with southwesterly flow. Jet streams frequently move south or break up with smaller wind cores over the station, stirring strong winds as far down as the surface. Cirrus and some altocumulus is generated on the upslope of these troughs.

The poorest flying weather is produced when a deep 500mb low closes off a couple hunared miles west-southwest of San Diego and persists from one to four weeks due to upper air blocking. This provides a mechanism for shortwave impulses to travel through the southern California region. Overrunning and lifting of the moist tropical air from the south produces widespread precipitation. Upper air soundings initially indicate veering winds with height. The surface pattern shows a wedge of high pressure from the Pacific Northwest extending over the plateau states and an inverted trough extending off the southern California coast. (fig 3-4).

Weather at George is predominantly overcast skies below 5,000' with lower ceilings and some fog formation at night and early morning hours. Precipitation is intermittant, often occurring for periods of only one to three hours at a time. Winds are generally gusty from 060$^{\circ}$ - 150$^{\circ}$. When the system moves out, it does so quickly, towards the east. A slight northeasterly movement will

Fig 3-4



normally bring it right over George.

Due to the stability of the Continental Polar air mass and the mountain barriers to the west and northwest, it is a rare event that George gets any strong cold air advection at the surface. The two noted exceptions are: 1) A strong low pressure area along the Washington/Oregon coast and an intense high pressure area in central Canada pushing CP air through the lower passes in the northern Rockies across Washington, Oregon and into the coastal regions west of the Sierra Nevadas, and 2) When the mean position of the Polar front shifts 800-1,000 miles to the west into the Great Basin area and continuous Polar outbreaks bring unusually severe weather to the entire Pacific Coast.

3-7 Fronts. During the short transition period, the occasional fronts reaching the station are weak, acting more like troughs aloft with little associated precipitation but usually with increased wind speeds. Winter brings several fronts with associated weather and cloud cover. The Great Basin high gives us periods of 10-12 days without frontal activity by blocking fronts. When the high breaks down, the upper level jets locate southward over our station, a low develops off the coast and trough and frontal passages can be as often as every 18-24 hours.

The mountains to the west normally trap the fronts, forcing colder air up over the warm air sector, further occluding the front. When the air drops over the lee side of the mountains, it dries and seldom reaches the station with the front. As a result, the temperature and dew point discontinuities do not accompany the front, only the pressure dip. If the winds are strong and persistant and have a southwesterly component, a roll cloud effect will be sustained by moisture through the pass giving us persistant 300-1,000 foot ceilings.

3-8 Winter Visibility Obstructions. Winter weather systems bring slightly lower visibilities than summertime because of the precipitation, haze and ground fog. Increased cloudiness also reduces visibility over long distances, but for the most part, visibilities are unrestricted.

Fog is a rare event due to the usual dryness of the air and the active winds. Some may form in the saturated air after rains, especially with northerly winds to give a little lift. Surrounding lake beds, flooded after heavy rains, are also a good moisture source but rarely affect the base because it is located on a mesa.

Smoke from the cement plants northeast and southeast of the base does not reduce our visibility but can in the Mojave River Valley where a strong inversion can help drop visibility to 2-3 miles.

On occasion the winds will get strong enough to raise some dust and sand but this is usually not wide spread enough to reduce visibilities any length of time.

3-9 Winter Hazardous Weather

a. **Thunderstorms.** While thunderstorms can occur in the winter, they are rare and usually associated with frontal or strong wave activity. As in summer, gusty winds are the greatest hazard.

b. **Gusty Winds.** Strong (30kts +) gusty winds are frontal associated, often with the passage of the 700mb trough. The jet or jet fingers move over the station, increasing the strength and duration of the winds. Local wind studies (see Chapter 4) have been effective in predicting these gusts.

c. **Tornadoes/Hail.** These phenomena have not been observed during the winter months at George but have in the surrounding mountains and the Los Angeles basin.

d. **Turbulence.** As in the summer, turbulence is restricted primarily to the surrounding mountains. Trough and frontal passages can bring turbulence down to the surface, for longer periods and more frequently than in the summer.

e. **Icing.** The freezing level generally remains 7-9,000 feet MSL but does drop to the surface on occasion after a cold front. Systems often advect enough moisture to give us light - moderate rime.

f. **Snow.** December and January are the primary snow months but light snowfalls have been observed from October through May. Most falls are light and unless the ground temperature is low enough, will not accumulate. Heavy falls can occur in conjunction with the San Diego low situation. Any snow accumulation is critical because of limited snow removal and aircraft deicing equipment.

g. **Flooding.** Flooding of valleys and low spots in the surrounding desert is fairly common in the winter. Light winter rains start to cause puddling within an hour and greater intensity or duration means heavy runoff, collecting in dry lakebeds and low areas and dips in the roads. Closures are usually temporary (less than a day). On base the runoff is slow because there is little slope in the land and the curbed roads act as storm drains. During the heaviest downpours the roads in the northwest corner of the base can become impassible.

# Chapter 4

# Climatology

## REMARKS

### ANNUAL MEANS

**TEMPERATURES**

MAXIMUM ° F ........ 75
MINIMUM ° F ........ 48
AVERAGE ° F ........ 62
NO DAYS MAX > 90° F ........ 155
NO. DAYS MIN < 32° F ........ 45
NO. DAYS MIN > 65° F ........ 53

**PRECIPITATION**

NO. DAYS ........ 21
ANNUAL TOTAL (inches) ........ 3.8
NO. DAYS SNOW ........ 2
ANNUAL TOTAL (inches) ........ 2.7

**FLYING WEATHER**

DAYS CIG/VSBY LT 10,000/5 ........ 3.8
DAYS CIG/VSBY LT 2,500/5 ........ 0.8
DAYS CIG/VSBY LT 400/1 ........ *
THUNDERSTORM DAYS ........ 8

## CLIMATOLOGICAL FACTS

FOR
GEORGE AIR FORCE BASE, CALIFORNIA

BASED ON WEATHER DATA COMPILED BY
GEORGE AFB WEATHER STATION

DETACHMENT 12
2[illegible] WEATHER SQ
GEORGE AIR FORCE BASE, CALIFORNIA

AS OF DEC 74

## GEORGE AIR FORCE BASE, CALIFORNIA

| MONTH | TEMPERATURES: Mean daily maximum °F | Mean daily minimum °F | Mean monthly °F | No. days max above 90°F | No. days max [illegible] | No. days min below 32°F | No. days min above 65°F | EXTREMES: Highest °F | Year | Lowest °F | Year | LIGHT DATA: Sunrise LST 2nd of month | Sunset LST 2nd of month | | | PRECIPITATION: Mean amount (inches) | Greatest total (inches) | Lowest total (inches) | Year | Greatest amount in 24 hrs | Year | No. days precipitation | SNOWFALL: No. days snow | Mean amount (inches) | Max amount in 24 hrs | Greatest total (inches) | FLYING WEATHER: Days CIG/VSBY LT 10,000/5 | Days CIG/VSBY LT 2,500/3 | Days CIG/VSBY LT 400/1 | Thunderstorm days |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JAN | 57 | 33 | 45 | * | 0 | 15 | 0 | 80 | 71 | 9 | 63 | 0654 | 1700 | | | 0.7 | 2.0 | 0 | - | 1.7 | 60 | 3 | 1 | 1.0 | 17 | 17 | 3 | 1 | * | * |
| FEB | 60 | 36 | 48 | 0 | 0 | 9 | 0 | 79 | 72 | 10 | 65 | 0629 | 1730 | | | 0.6 | 3.9 | 0 | - | 1.9 | 44 | 3 | * | 0.2 | 2.0 | 2.4 | 3 | 1 | * | 0 |
| MAR | 65 | 38 | 52 | 2 | 16 | 5 | 0 | 87 | 72 | 16 | 71 | 0652 | 1802 | | | 0.4 | 1.5 | 0 | - | 1.1 | 43 | 2 | * | 0.3 | 2.3 | 3.4 | 3 | 1 | * | * |
| APR | 71 | 44 | 58 | 7 | 22 | * | 0 | 94 | 61 | 20 | 66 | 0611 | 1826 | | | 0.2 | 1.2 | 0 | - | 0.4 | 58 | 2 | * | 0.1 | 1.2 | 1.2 | 3 | * | * | * |
| MAY | 79 | 51 | 65 | 17 | 28 | 0 | 1 | 100 | 60 | 26 | 53 | 0443 | 1800 | | | 0.1 | 0.4 | 0 | # | 0.3 | 60 | 1 | * | T | 0.3 | 0.3 | 1 | * | 0 | * |
| JUN | 88 | 58 | 74 | 25 | 30 | 0 | 5 | 113 | 72 | 41 | 53 | 0437 | 1905 | | | * | 0.2 | 0 | # | 0.1 | 60 | 1 | 0 | 0 | 0 | 0 | * | * | 0 | 1 |
| JUL | 97 | 67 | 82 | 31 | 31 | 0 | 20 | 111 | 72 | 50 | 40 | 0462 | 1800 | | | 0.1 | 0.7 | 0 | # | 0.7 | 45 | 1 | 0 | 0 | 0 | 0 | 1 | * | 0 | 2 |
| AUG | 96 | 66 | 81 | 30 | 31 | 0 | 19 | 108 | 70 | 40 | 60 | 0514 | 1830 | | | 0.2 | 1.3 | 0 | # | 0.5 | 63 | 1 | 0 | 0 | 0 | 0 | 1 | * | 0 | 2 |
| SEP | 89 | 58 | 74 | 26 | 30 | 0 | 7 | 107 | 46 | 30 | 40 | 0537 | 1740 | | | 0.2 | 2.5 | 0 | # | 1.4 | 63 | 1 | 0 | 0 | 0 | 0 | 1 | * | 0 | 1 |
| OCT | 78 | 50 | 64 | 15 | 30 | * | * | 96 | 64 | 20 | 71 | 0600 | 1700 | | | 0.2 | 1.5 | 0 | # | 1.2 | 63 | 1 | 0 | 0 | T | T | 2 | * | * | * |
| NOV | 65 | 40 | 52 | 1 | 16 | 1 | 0 | 85 | 60 | 10 | 64 | 0630 | 1642 | | | 0.5 | 1.0 | 0 | - | 1.8 | 54 | 2 | * | 0.4 | 0.8 | 0.2 | 2 | * | * | * |
| DEC | 57 | 34 | 46 | * | 0 | 13 | 0 | 80 | 30 | 16 | 72 | 0653 | 1643 | | | 0.8 | 3.3 | 0 | - | 1.5 | 63 | 3 | 1 | 0.1 | 5.0 | 7.0 | 3 | 1 | * | * |
| YRS REC | 29 | 29 | 29 | 29 | 28 | 29 | 29 | 29 | - | 29 | - | | | | | 29 | 29 | 29 | - | 29 | - | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 |

* LESS THAN ½ DAY, ½% OR .05 INCH
\- DATA NOT AVAILABLE
T LESS THAN 0.05 INCH RAINFALL OR LESS THAN 0.1 INCH SNOWFALL
** DATA THROUGH 1972
\# : [illegible]

Fig 4-2

| PREPARED BY USAFETAC FEBRUARY 1978 | STATION NAME GEORGE AFB CA (VICTORVILLE) LOCATION N34 35 W117 23 | PERIOD FEB 42-DEC 76 R ELEV 2875 | STN LTRS VCV WBAN NO 23131 WMO NO |
|---|---|---|---|

# AWS CLIMATIC BRIEF

| MONTH | TEMPERATURE (°F) MEAN DAILY MAX | MEAN DAILY MIN | MEAN MONTHLY | EXTREME MAX | EXTREME MIN | PRECIPITATION (IN) MONTHLY MEAN | MONTHLY MAX | MONTHLY MIN | MAX 24 HRS | SNOWFALL (IN) MONTHLY MEAN | MONTHLY MAX | MAX 24 HRS | MEAN RELATIVE HUMIDITY (%) LST 04 | 13 | VAPOR PRESSURE (IN Hg) | DEW PT (°F) | PRESSURE ALTITUDE (FT) 99.95% | SURFACE WINDS PVLG DRCTN (16 PT) | SPEED MEAN (KT) | SPEED MAX (KT) ** | MEAN CLOUD COVER (tenths) | MEAN NUMBER OF DAYS OCCURRENCE OF: PRECIP (IN) ≥ 0.01 | ≥ 0.5 | SNOWFALL (IN) ≥ 0.1 | ≥ 1.5 | THUNDERSTORMS | FOG VSBY < 7 MI | TEMPERATURE (°F) MAX ≥ 90 | MAX ≥ 80 | MIN ≤ 32 | MIN ≤ 00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JAN | 57 | 33 | 45 | 80 | 9 | .7 | 2.8 | .0 | 1.7 | 2 | 17 | 16 | 58 | 33 | .12 | 23 | 3200 | S | 5 | 54 | 4 | 3 | # | # | # | # | 2 | 0 | # | 15 | 0 |
| FEB | 60 | 36 | 48 | 79 | 18 | .6 | 3.9 | .0 | 1.9 | # | 2 | 2 | 60 | 34 | .15 | 27 | 3200 | S | 7 | 52 | 4 | 3 | # | # | # | # | 1 | 0 | 0 | 8 | 0 |
| MAR | 64 | 40 | 52 | 86 | 18 | .4 | 1.6 | .0 | 1.1 | # | 3 | 2 | 57 | 29 | .15 | 28 | 3250 | W | 8 | 62 | 4 | 3 | # | # | # | # | 1 | 0 | 2 | 4 | 0 |
| APR | 71 | 44 | 58 | 94 | 29 | .2 | 1.2 | .0 | .4 | # | 1 | 1 | 56 | 24 | .15 | 28 | 3200 | W | 9 | 52 | 3 | 2 | 0 | # | 0 | # | # | # | 6 | # | 0 |
| MAY | 80 | 51 | 66 | 100 | 35 | .1 | .9 | .0 | .3 | # | # | 02 | 51 | 20 | .20 | 35 | 3200 | S | 8 | 46 | 2 | 1 | 0 | # | 0 | 1 | # | 4 | 18 | 0 | 0 |
| JUN | 89 | 59 | 74 | 111 | 41 | # | .2 | .0 | .2 | 0 | 0 | 0 | 47 | 18 | .24 | 39 | 3150 | S | 8 | 46 | 2 | # | 0 | 0 | 0 | # | # | 15 | 25 | 0 | 0 |
| JUL | 97 | 67 | 82 | 110 | 50 | .1 | .7 | .0 | .7 | 0 | 0 | 0 | 40 | 18 | .29 | 44 | 3050 | S | 7 | 50 | 2 | 1 | # | 0 | 0 | 2 | # | 28 | 31 | 0 | 0 |
| AUG | 95 | 66 | 81 | 108 | 49 | .2 | 1.3 | .0 | .5 | 0 | 0 | 0 | 42 | 19 | .30 | 45 | 3050 | S | 6 | 44 | 2 | 1 | # | 0 | 0 | 3 | # | 27 | 30 | 0 | 0 |
| SEP | 89 | 60 | 75 | 107 | 38 | .2 | 3.3 | .0 | 2.9 | 0 | 0 | 0 | 49 | 22 | .27 | 42 | 3100 | S | 6 | 39 | 1 | 1 | # | 0 | 0 | 1 | 1 | 16 | 26 | 0 | 0 |
| OCT | 78 | 50 | 64 | 95 | 28 | .2 | 1.5 | .0 | 1.2 | # | # | # | 47 | 23 | .17 | 31 | 3150 | S | 6 | 54 | 2 | 1 | # | 0 | 0 | # | 1 | 3 | 14 | # | 0 |
| NOV | 65 | 40 | 53 | 85 | 10 | .5 | 1.8 | .0 | 1.6 | # | 9 | 9 | 44 | 30 | .15 | 26 | 3200 | S | 6 | 51 | 3 | 2 | # | # | # | # | 1 | 0 | 1 | 4 | 0 |
| DEC | 57 | 34 | 45 | 86 | 15 | .6 | 3.9 | .0 | 1.5 | 1 | 8 | 6 | 60 | 36 | .12 | 23 | 3250 | S | 5 | 56 | 3 | 3 | # | # | # | # | 2 | 0 | # | 13 | 0 |
| ANN | 75 | 48 | 62 | 111 | 9 | 3.8 | 3.9 | .0 | 2.9 | 3 | 17 | 16 | 52 | 26 | .19 | 33 | 3200 | S | 7 | 62 | 3 | 21 | # | # | # | 7 | 9 | 93 | 153 | 44 | 0 |
| EYR | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 91 | 31 | 27 | 27 | 27 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 27 | 10 | 31 | 31 | 27 | 27 | 27 | 27 | 31 | 31 | 31 | 31 |

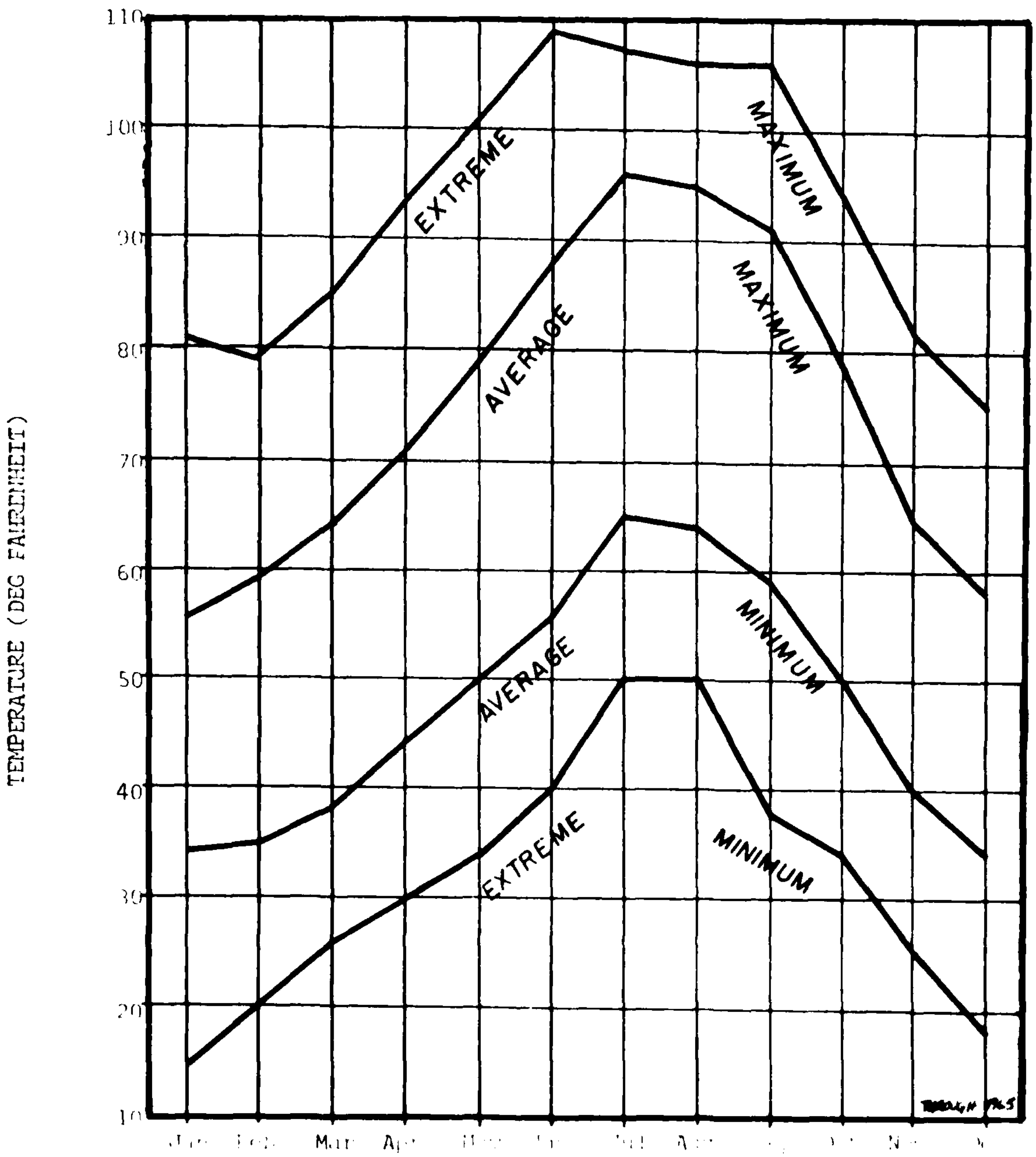
REMARKS RUSSWO POR:
HOURLY OBS: JAN 47-DEC 76

DAILY OBS: FEB 42-FEB 46, APR-OCT 46, SEP 50-DEC 76

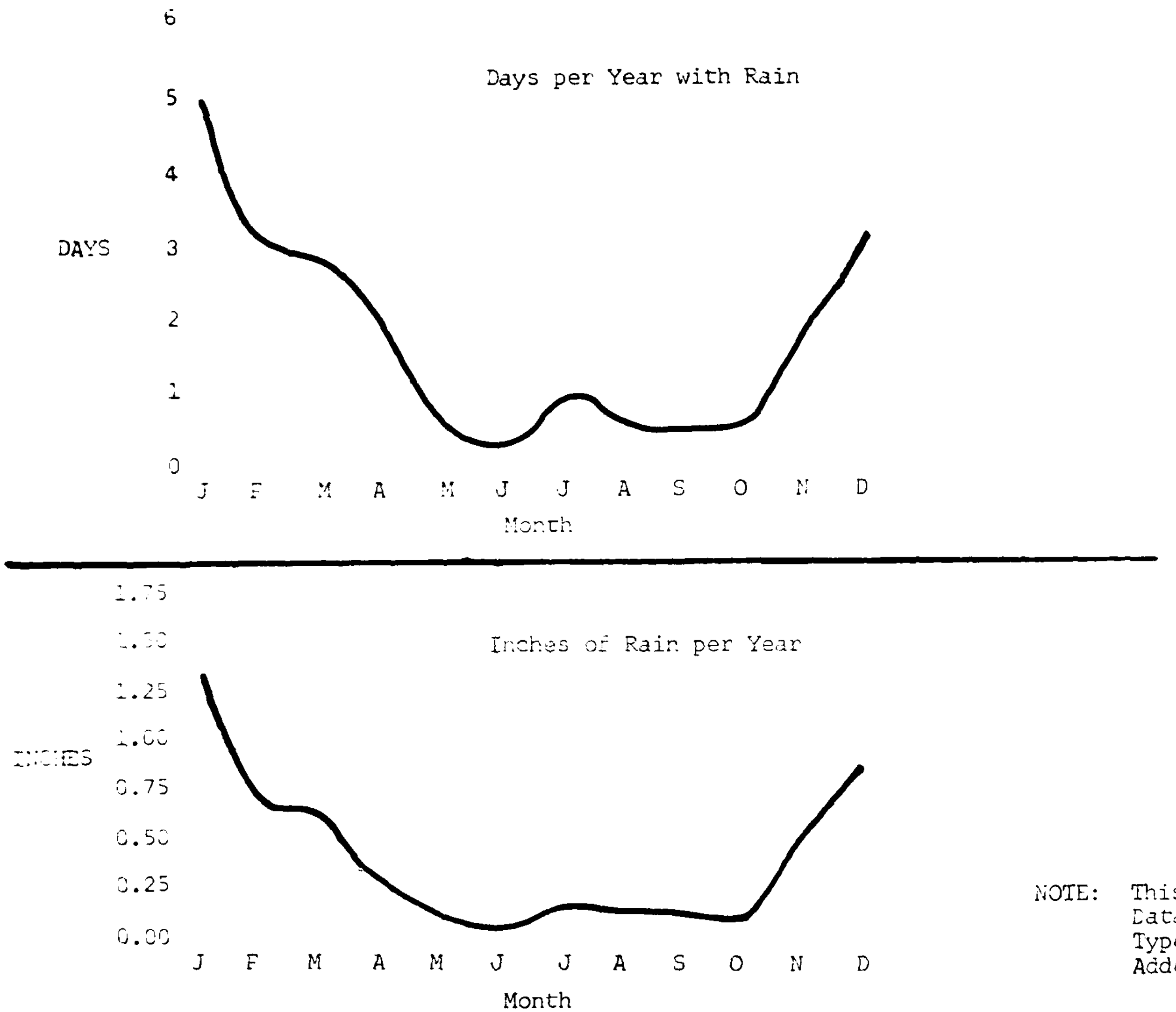
NOTE: * DATA NOT AVAILABLE # AMTS < UNITS SHOWN IN HEADING ** INSTANTANEOUS PEAK WINDS S CALM GRTR % PLVG DRCTN + BASED ON < FULL MONTHS

| CAV FREQ (%) | HRS LST | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANN | EYR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CEILING LESS THAN 3000 FT AND OR VISIBILITY LESS THAN 3 MI | 00-02 | 2 | 1 | 1 | 1 | 0 | 0 | # | # | # | 0 | # | 3 | 1 | |
| | 03-05 | 2 | 2 | 1 | 1 | # | 0 | 0 | # | 1 | 0 | 1 | 2 | 1 | |
| | 06-08 | 4 | 3 | 2 | 1 | 1 | 0 | # | 0 | 1 | 1 | 1 | 2 | 1 | |
| | 09-11 | 4 | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 1 | # | 1 | 2 | 1 | |
| | 12-14 | 2 | 4 | 2 | 2 | # | # | # | 0 | 1 | # | 1 | 3 | 1 | |
| | 15-17 | 3 | 3 | 2 | 1 | 0 | 1 | 0 | # | 1 | 1 | 1 | 3 | 1 | |
| | 18-20 | 3 | 2 | 1 | # | # | # | 0 | # | # | # | # | 2 | 1 | |
| | 21-23 | 3 | 1 | 1 | 1 | 0 | 0 | 0 | # | # | 0 | 1 | 3 | 1 | |
| | ALL HRS | 3 | 2 | 2 | 1 | # | # | # | # | 1 | # | 1 | 3 | 1 | 10 |
| CEILING LESS THAN 1500 FT AND OR VISIBILITY LESS THAN 3 MI | 00-02 | 1 | # | # | # | 0 | 0 | # | # | # | 0 | 0 | 2 | # | |
| | 03-05 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | # | 0 | 0 | # | 2 | # | |
| | 06-08 | 3 | 1 | # | # | # | 0 | # | 0 | 1 | # | 1 | 1 | 1 | |
| | 09-11 | 3 | 1 | 1 | 1 | # | 0 | 0 | 0 | # | 0 | 1 | 1 | 1 | |
| | 12-14 | 1 | 1 | 1 | 1 | 0 | # | # | 0 | 1 | # | 1 | 2 | 1 | |
| | 15-17 | 2 | 1 | # | 1 | 0 | 1 | 0 | # | 1 | # | # | 1 | 1 | |
| | 18-20 | 2 | # | # | # | # | # | 0 | # | # | # | # | 2 | # | |
| | 21-23 | 2 | 1 | # | 0 | 0 | 0 | 0 | # | # | 0 | 0 | 2 | # | |
| | ALL HRS | 2 | 1 | # | # | # | # | # | # | # | # | # | 2 | # | 10 |
| CEILING LESS THAN 1000 FT AND OR VISIBILITY LESS THAN 2 MI | 00-02 | 1 | # | # | 0 | 0 | 0 | 0 | # | 0 | 0 | 0 | 2 | # | |
| | 03-05 | 1 | # | 0 | 0 | 0 | 0 | 0 | # | 0 | 0 | # | 1 | # | |
| | 06-08 | 2 | # | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | # | 1 | # | |
| | 09-11 | 2 | 1 | # | # | # | 0 | 0 | 0 | # | 0 | # | 1 | # | |
| | 12-14 | 1 | 1 | # | # | 0 | # | 0 | 0 | # | 0 | # | 2 | # | |
| | 15-17 | 1 | 1 | # | # | 0 | # | 0 | 0 | 1 | 0 | # | 1 | # | |
| | 18-20 | 1 | 1 | # | 0 | # | 0 | 0 | 0 | 0 | 0 | 0 | 1 | # | |
| | 21-23 | 1 | 0 | # | 0 | # | 0 | 0 | # | 0 | 0 | 0 | 1 | # | |
| | ALL HRS | 1 | # | # | # | # | # | 0 | # | # | # | # | 1 | # | 10 |
| CEILING LESS THAN 200 FT AND OR VISIBILITY LESS THAN 1/2 MI | 00-02 | # | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | # | # | |
| | 03-05 | # | # | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | # | # | |
| | 06-08 | # | # | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | # | # | |
| | 09-11 | 1 | 0 | 0 | 0 | # | 0 | 0 | 0 | 0 | 0 | 0 | # | # | |
| | 12-14 | # | # | 0 | 0 | 0 | # | 0 | 0 | # | 0 | 0 | 0 | # | |
| | 15-17 | # | # | 0 | 0 | 0 | # | 0 | 0 | # | 0 | 0 | # | # | |
| | 18-20 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | # | 0 | 0 | 0 | 0 | |
| | 21-23 | # | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | # | # | |
| | ALL HRS | # | # | 0 | [illegible] | # | # | [illegible] | [illegible] | # | 0 | 0 | # | # | 10 |

TEMPERATURE



PRECIPITATION DATA



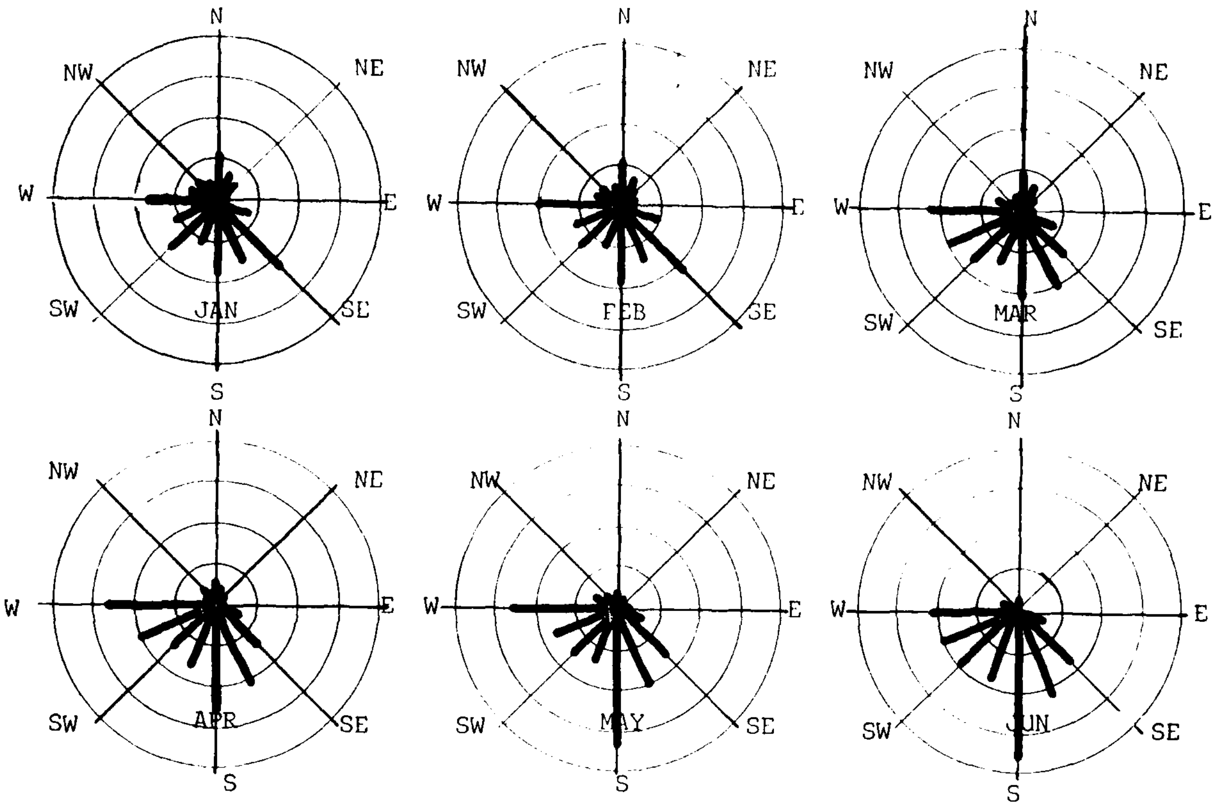

NOTE: This Precipitation Data is For Rain Types Only. Snow Added Only a Trace.

Fig 4-4

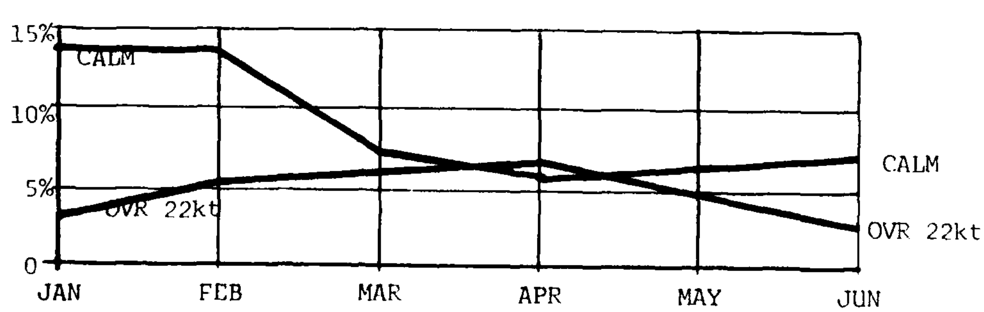
Fig 4-5



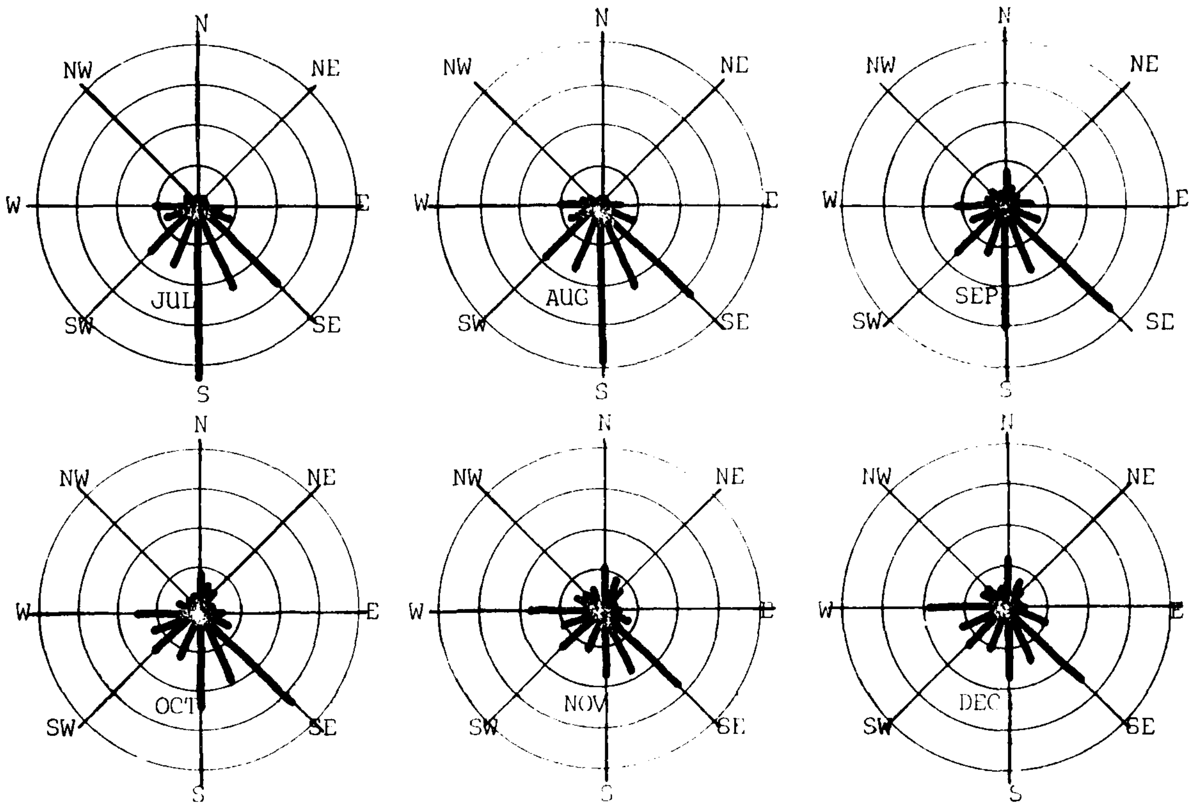
FREQUENCY OF OCCURRENCE OF WINDS BY DIRECTION (EACH CIRCLE 5%)




FREQUENCY OF WIND SPEEDS



FREQUENCY OF OCCURRENCE OF WINDS BY DIRECTION (EACH CIRCLE - 5%)




FREQUENCY OF WIND SPEEDS

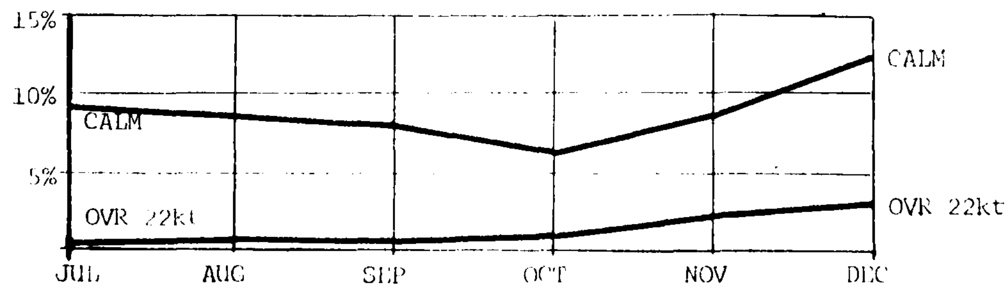
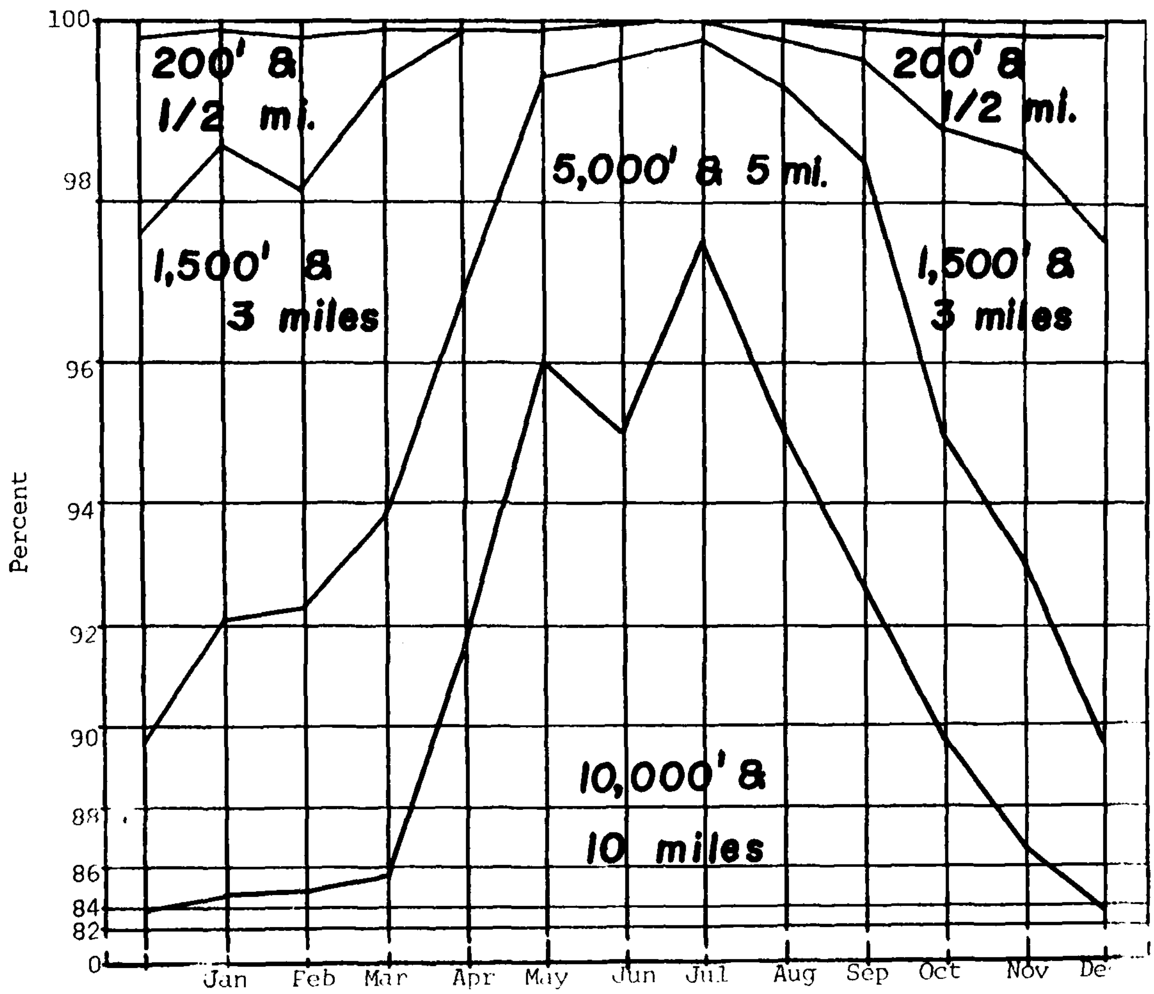


Fig 4-6


100
98
96
94
92
90
88
86
84
82
0
Percent
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
De
200' & 1/2 mi.
200' & 1/2 mi.
5,000' & 5 mi.
1,500' & 3 miles
1,500' & 3 miles
10,000' & 10 miles

SKY COVER

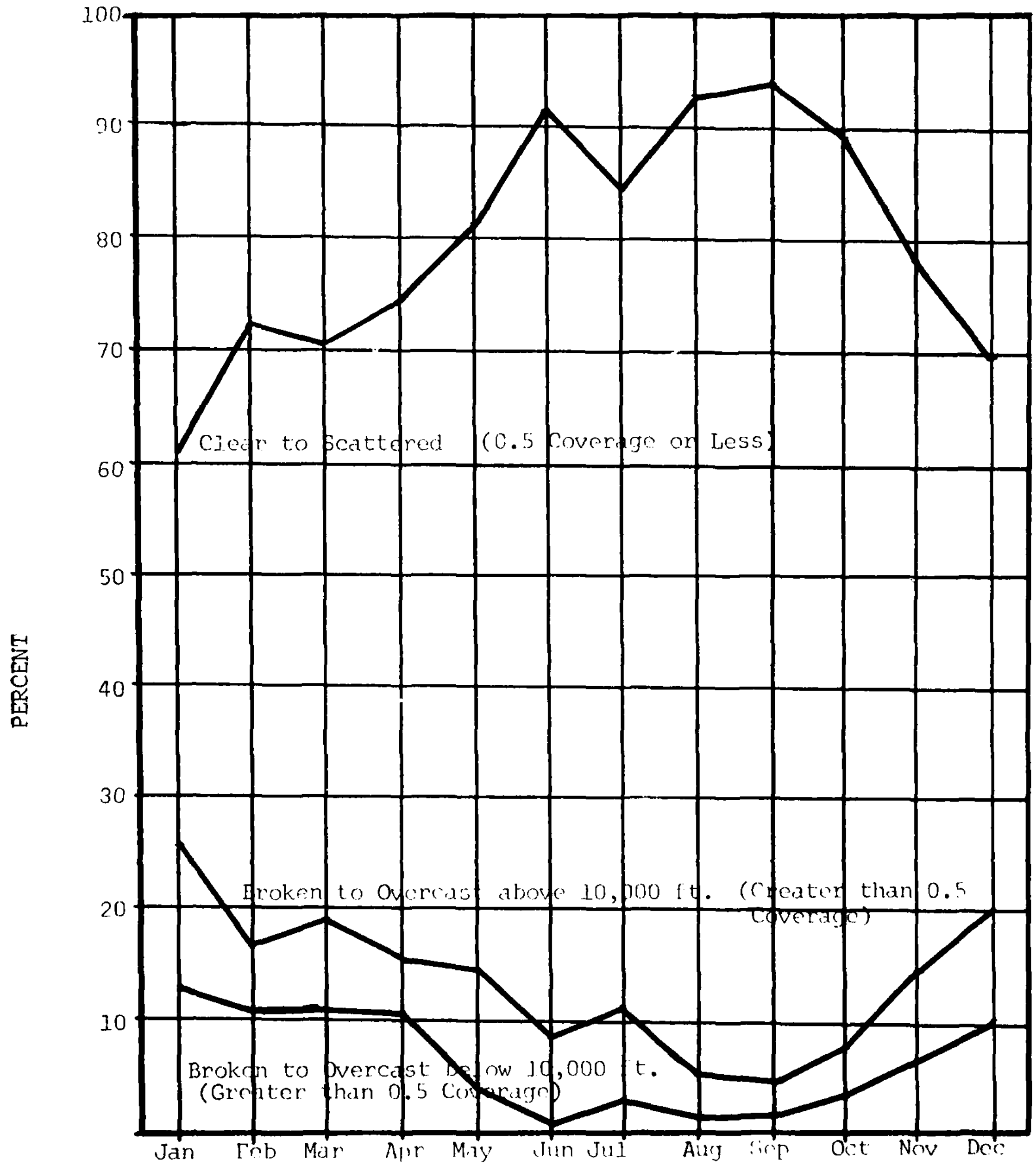

PERCENT
100
90
80
70
60
50
40
30
20
10
Clear to Scattered (0.5 Coverage or Less)
Broken to Overcast above 10,000 ft. (Greater than 0.5 Coverage)
Broken to Overcast below 10,000 ft. (Greater than 0.5 Coverage)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

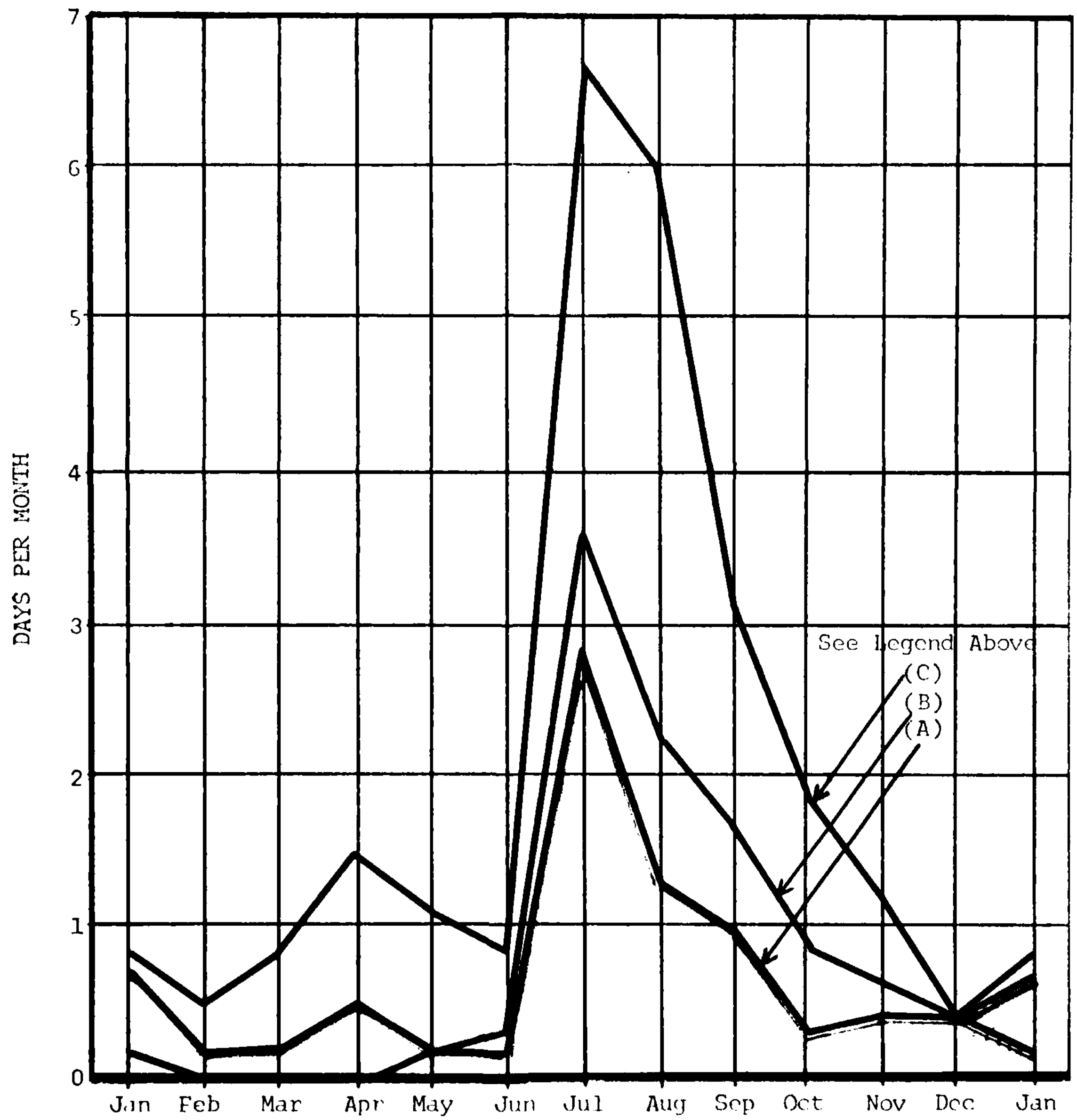
Fig 4-8

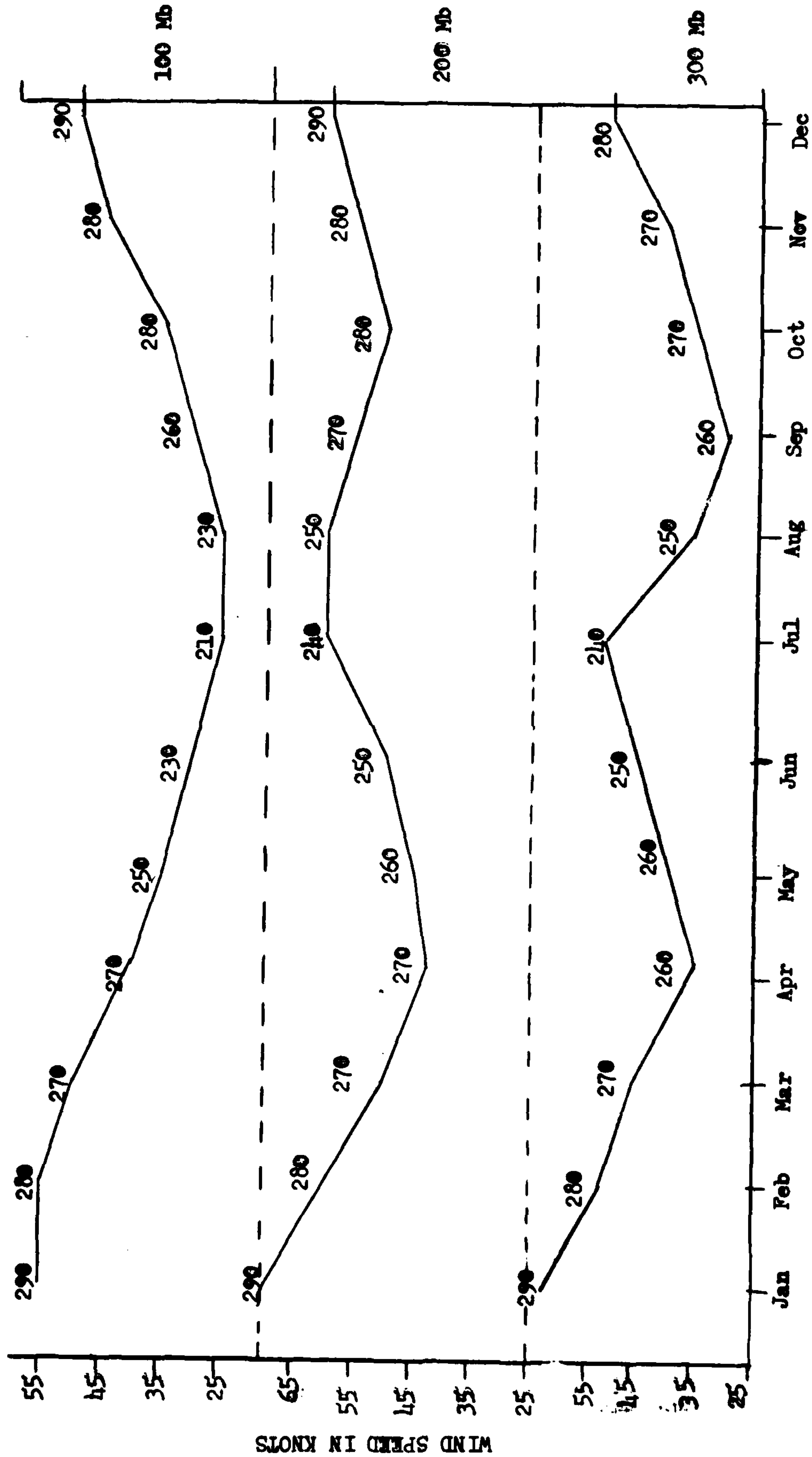


(A) Thunderstorm at George AFB. (WBAN 10A, Col. 5)

(B) Lightning Recorded in Sight of George AFB. (WBAN 10A, Col. 13 and (A) above)

(C) Cumulonimbus Sighted at or in the Vicinity of George AFB. (WBAN 10A, Col 13, and (A) or (B) above)






MEAN WIND SPEEDS AND DIRECTIONS OVER GEORGE AFB

Fig 4-10



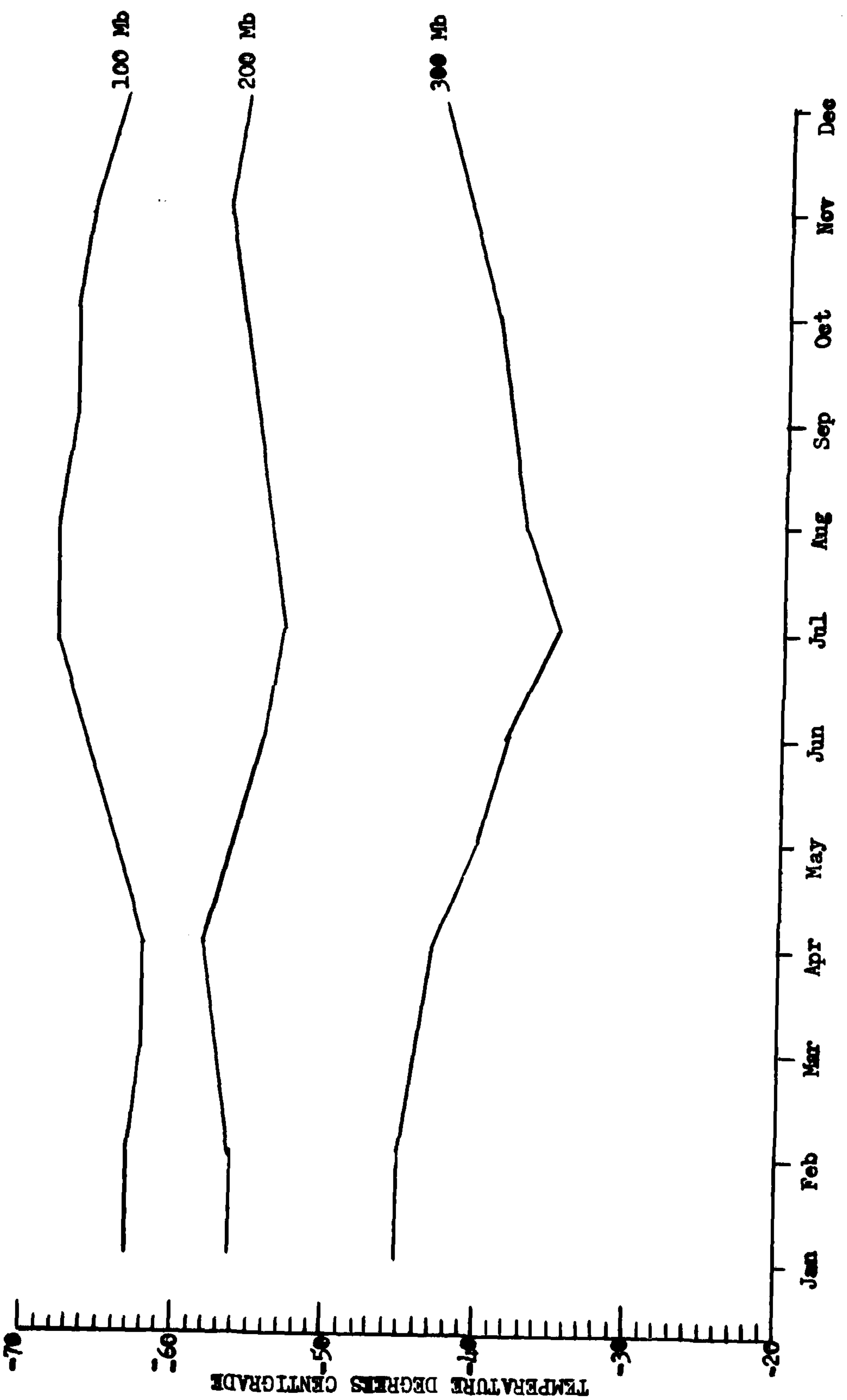
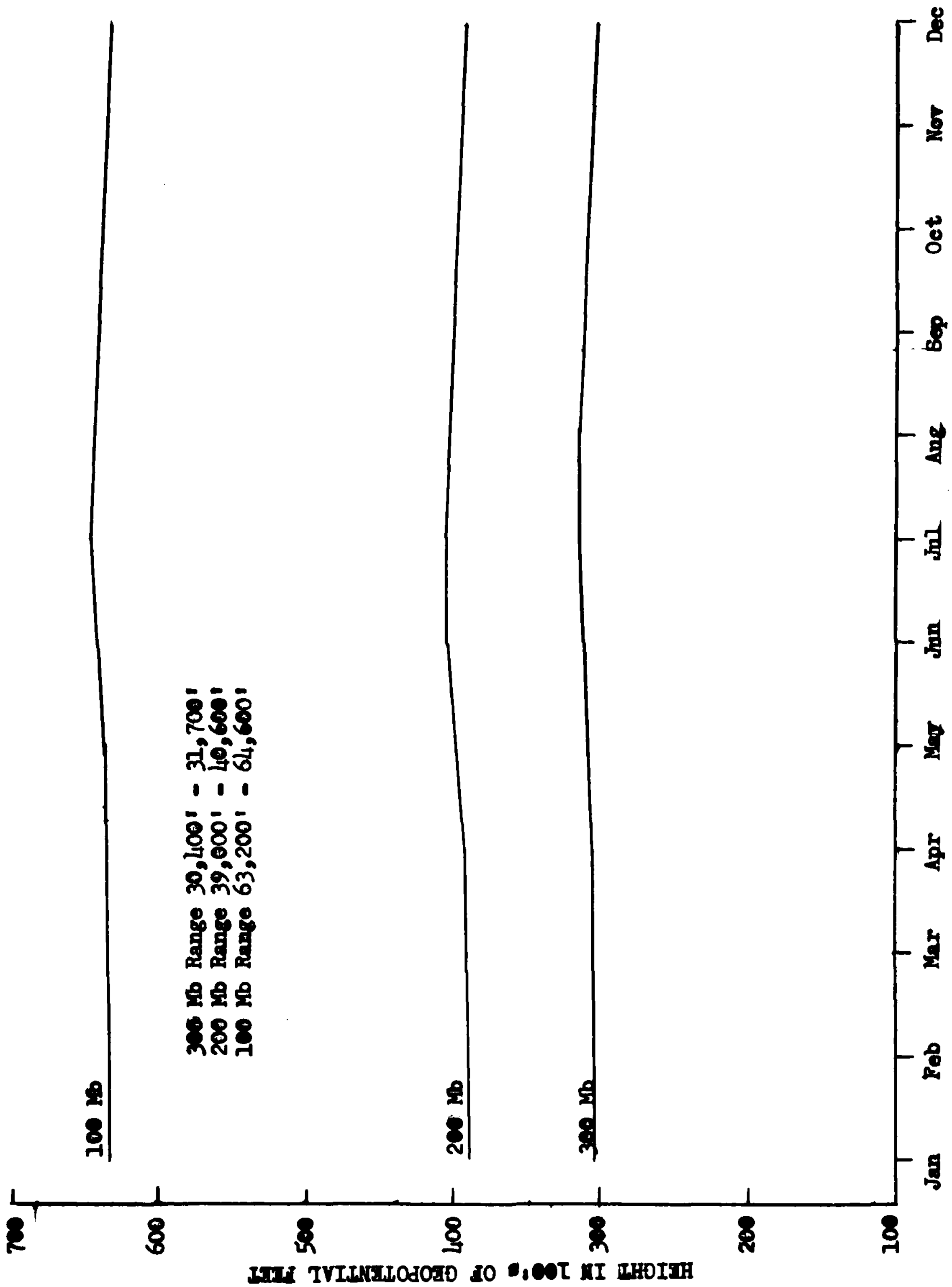

100 Mb
200 Mb
300 Mb
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
-70
-60
-50
-40
-30
-20
TEMPERATURE DEGREES CENTIGRADE

Fig 4-11


100 Mb
200 Mb
300 Mb
300 Mb Range 30,400' - 31,700'
200 Mb Range 39,000' - 40,600'
100 Mb Range 63,200' - 64,600'
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
700
600
500
400
300
200
100
HEIGHT IN 100's OF GEOPOTENTIAL FEET

Det 12, 25WS, George AFB, CA 92392

17 July 1980

OPERATIONALLY SIGNIFICANT FORECAST PROBLEMS

1. Surface Winds: Strong gusty surface winds during the winter pose the most difficult forecast problem at George AFB. While our strongest winds most often occur with a well defined surface frontal system and associated troughing aloft, one can expect gusty winds with zonal flow, providing a vigorous jet stream exists far enough south over California to initiate short wave impulses aloft and resultant surface pressure gradients over the desert. The most common wind-inducing synoptic patterns include an "upper level" trough digging southward from the Gulf of Alaska, with a cold core low evident at 500 and 700 mbs, that defines a NE-SW oriented Surface Cold Front; a Nevada Surface Low with associated frontogenesis; and a cut-off low, of long w... itude, evident at 500mbs, positioned just SW of San Diego. These winds occasionally gener... blowing dust and/or sand which can reduce visibility to as low as ¼ mile, as well as advect in haze and smoke from the Los Angeles Basin. Forecasting the onset and direction of these phenomena involves accurate analysis of upper winds below 20,000 ft, surface pressure gradients throughout the Southwest U.S., upstream from George AFB, and frontal or trough passage. The extent of visibility reduction will often depend on the amount of precipitation received within the previous two weeks. Specific Problems: To forecast intensity, direction and duration surface winds in excess of 25kts 3 hours or more prior to onset. Action Taken to Resolve Problem:

a. Approved Bickett Wind Study (Mar 1965) which uses the 500mb height and wind field.

b. Approved Calentine Wind Study (May 1973) which uses a surface pressure gradient field around George AFB.

c. Approved Stobie Wind Study (May 1974) which uses Calentine's pressure gradient study as in initial conditon, and then correlates 500mb height changes, (OAK, VBG, LSV, EDW), to anticipate cold air advection, in order to forecast gusty surface winds at George AFB.

2. Covective Thunderstorms at George AFB: While the number of summer thunderstorm days at George average only seven from May through September, convective activity in the high desert has increased in recent years. For this reason, convective thunderstorms pose an operational problem, due to the possibility of electrical activity curtailing communications, refueling, power, and computer operations. The moisture associated with thunderstorm activity over the high desert is usually advected from either the Gulf of Mexico or the Gulf of California. Several days of weak southerly through east-south-easterly flow, often due to circulation around a high pressure system at 700mbs located over northern Arizona, will allow moist tropical air to overrun and create instability

aloft. Generally, early morning CB activity in the Colorado River Valley will indicate thunderstorms will be a problem in the Mojave Desert by the afternoon. Specific Problem: To forecast occurrence and severity of tuunderstorms at George AFB. Action Taken to Resolve Problem:

a. Trajectory bulletin information is being plotted for possible storm signatures as described on page 36 of the January 1975 Aerospace Sciences Review (ASR).

b. Total Totals (TT) and K-index are being completed for selected hours from the trajectory bulletin.

c. Approved Moore/Voglen thunderstorm study using corrective temperature, RH (Sfc 300mb, TT, & K-index).

Appendix 2 RULES OF THUMB

1. If skies are completely clear from horizon to horizon, forecast no change for next 24 hrs (99%).
2. Northerly winds aloft lower any ceiling that is below 2,500' (87%).

Appendix 3 Special Synoptic Studies and References

In seperate binder.

# An Objective Technique for Forecasting Surface Winds 25 Kts and Greater, With Their Direction at George AFB, CA (Valid Oct-Apr)

By

Bert. E. Calentine, SSgt, USAF

Detachment 12, 25WS, 5WW

May 1973

An Objective Technique for Forecasting Surface Winds 25 Kts

and Greater With Their Direction at George AFB, CA.

1. Introduction. The topographical effect of George Air Force Base is the most important single factor in determining critical wind speed and direction. Strong gusty surface winds during fall and winter months pose a most difficult forecasting problem. The general prevailing wind direction throughout the year at George is southerly. This direction corresponds well with the location of the Cajon Pass which is 20 miles south of George AFB. Another "prevailing" direction is westnorthwest, which frequently occurs during the daylight hours of the winter months. This direction correlates nicely with the location of the Newhall and Tehachapi Passes. Winter winds at George are normally associated with frontal passages and upper troughs.

2. Statement of the problem. Forecasting critical wind speed and directions affecting flying operations at George AFB, CA. Specific Problem. From the data available at 1200Z (0400P) to forecast wind wpeed of 25 knots or greater and associated direction.

3. Definition.

a. The Bickett wind study, "An Objectize Technique for Forecasting the Occurrence of Gusty Surface Wind in Excess of 30 Knots at George AFB, CA", was an invaluable aid in the development of this study. The collection of data for the Bickett study was used as dependent data to formulate this present study.

b. Verification was accomplished via use of scatter diagrams of the rate of change of sea level pressure between selected locations in Southern California and Nevada against observed recorded occurrence on the AWS Form 10s.

4. Data Analysis Background. RAOBs and the corresponding AWS Form 10 data for the season Oct through Apr and for the years 1965-1970, were collected, analyzed, and used as dependent data to formulate the study. The 1970-1971 and 1971-1972 seasons' data were used as independent data to test the study. Selected predictors used were a detailed analysis of 1200Z sea level pressure field for Bakersfield, CA (BFL), Los Angeles, CA (LAX), Nellis AFB, NV (LSV), and Daggett, CA (DAG). All data analyzed were assembled on worksheets and plotted as scatter diagrams. An analysis of the scatter diagrams was accomplished and the following conclusion derived. Using the forecast checklist (Atch 1) enter the graph provided (Atch 2) and from the point on the graph (numbered area) in which the plot falls forecast winds.

a. Area 1 - less than 25 knots.

b. Area 1A - 340-060 true less than 25 knots.

c. Area 1B - 220-310 true less than 25 knots.

d. Area 1C - 150-220 true less than 25 knots.

[illegible]

[illegible] occurrences. The former

[illegible] based on seven sets of data.

[illegible] possible

[illegible] of the

[illegible] verification.

[illegible] and 36 shots.

[illegible] without further testing.

Prefigurance

FORECAST

| | | YES | NO | TOTAL |
|---|---|---|---|---|
| OBSERVED | YES | 75 | [illegible] | 100 |
| | NO | 9 | 91 | 100 |

Contingency Table #2 (independent data, Oct-Apr 19[illegible] [illegible])

FORECAST

| | | YES | NO | TOTAL |
|---|---|---|---|---|
| OBSERVED | YES | 83 | 30 | 113 |
| | NO | 39 | 261 | 300 |
| | TOTAL | [illegible] | 291 | [illegible] |

% correct = 81

% occurrences forecast correctly = 73

Heidke skill score = [illegible]

Post Agreement

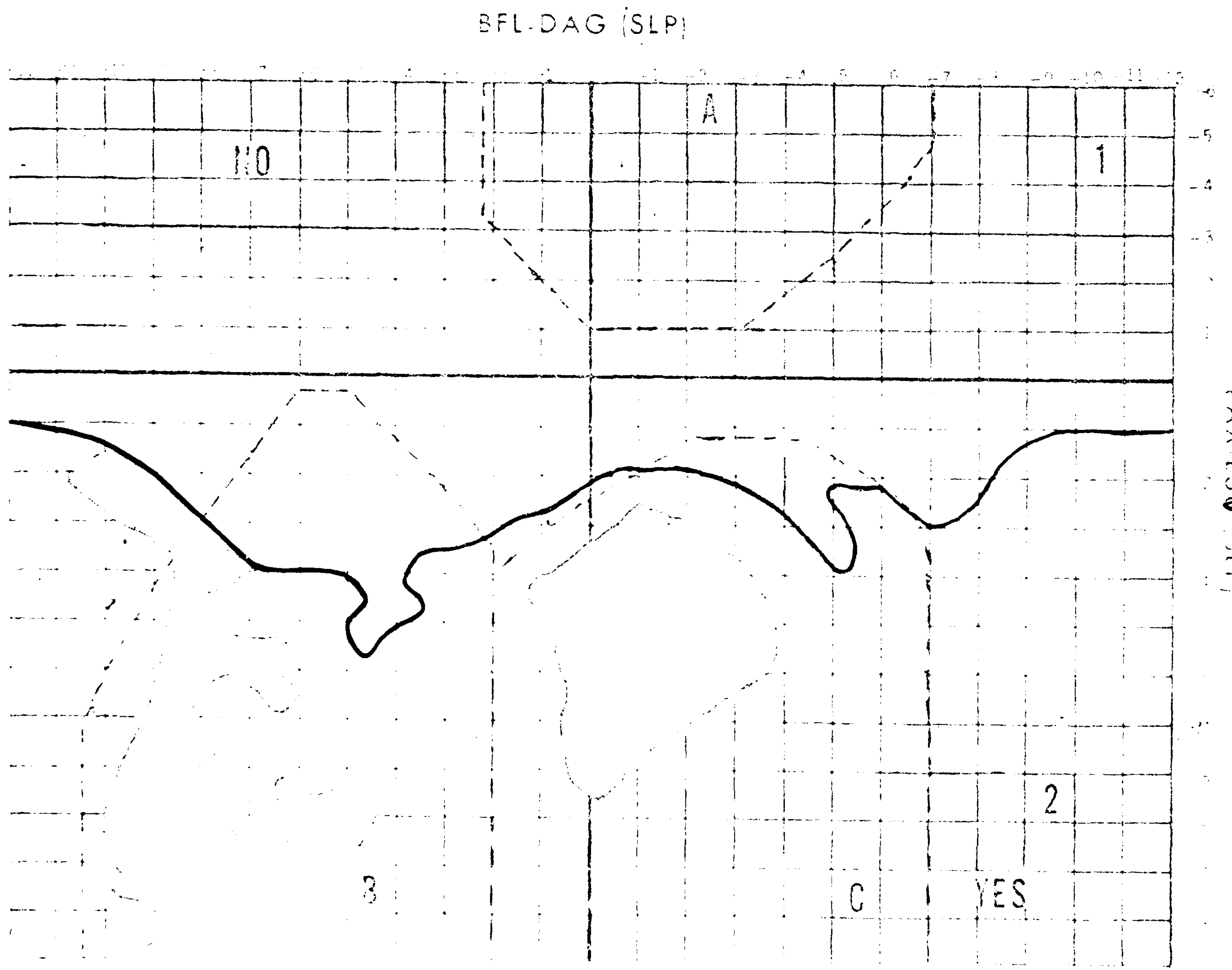
FORECAST

| | | YES | NO |
|---|---|---|---|
| OBSERVED | YES | 68 | [illegible] |
| | NO | [illegible] | 90 |
| | TOTAL | [illegible] | 100 |

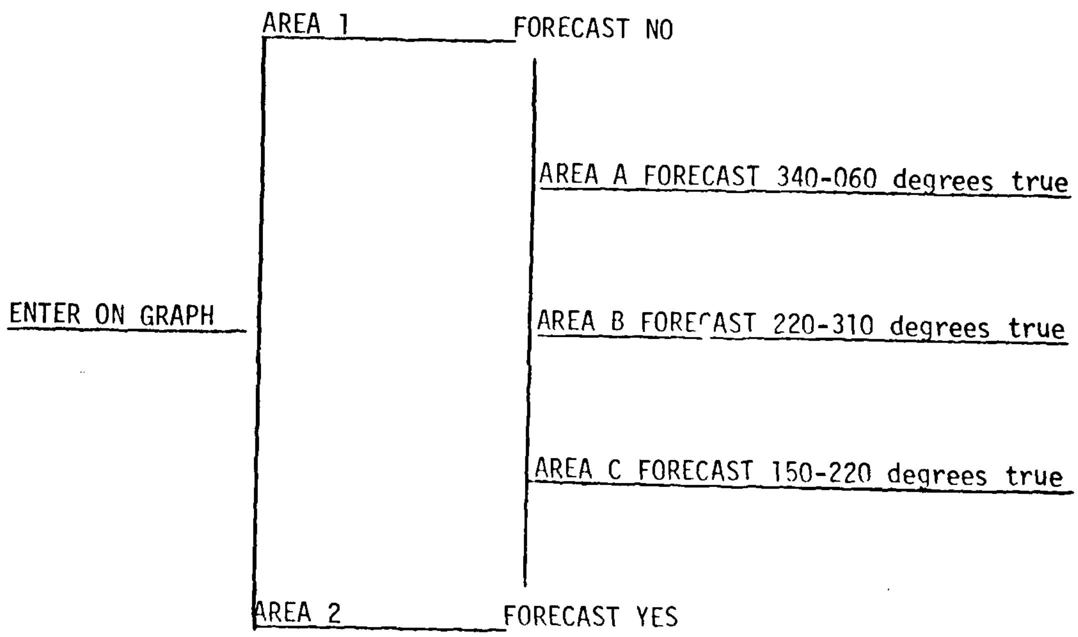
Pr[illegible]

FORECAST

| | | YES | NO | TOTAL |
|---|---|---|---|---|
| OBSERVED | YES | 73 | [illegible] | 90 |
| | NO | [illegible] | 87 | 100 |


BFL-DAG (SLP)
LAX-LSV (SLP)
NO
A
1
2
3
C
YES

FLOW CHART




| | DIRECTION | SPEED |
|---|---|---|
| FORECAST | ____________ | __________ |

(If plot doesn't fall in A, B or C, enter N/A for direction)

| | DIRECTION | SPEED |
|---|---|---|
| OBSERVED | ____________ | __________ |

(Enter perdominent direction of wind during strongest winds)

# FORECASTING SURFACE WINDS OVER 30 KTS AT GEORGE AFB USING SURFACE PRESSURE GRADIENTS AND 500MB HEIGHT CHANGES

BY

JAMES C. STOBIE, 1Lt, USAF

Detachment 12

5th Weather Wing

George AFB, California

May 1974

# FORECASTING SURFACE WINDS OVER 30 KTS AT GEORGE AFB

# USING SURFACE PRESSURE GRADIENTS AND 500MB HEIGHT CHANGES

1. Introduction. Gusty surface winds at George AFB during the winter months are usually associated with upper air troughs and/or surface cold fronts. The winds associated with these systems generally flow through the local mountain passes (Cajon Pass to the south, Soledad Pass to the southwest, and Tehachapi Pass to the west).

2. Statement of Problem. The objective of this study is to forecast daily peak surface winds greater than thirty knots during the months November through April. Each forecast is issued daily based on the 1200Z data and is valid until 1200Z the following day.

3. Definitions. A YES occurrence is defined as one when the peak wind exceeds thirty knots during the twenty-four hour period following the initial forecast. A NO occurrence is when the peak wind is thirty knots or less for the twenty-hour forecast period.

4. Data Analysis Background. The dependent data for this study were gathered from the NOAA Weekly Series of Daily Weather Maps. A small acetate overlay was made to fit over the 500MB analysis map. This overlay had an outline of the United States with small dots at OAK, VBG, SAN, WMC, LSV, and SAN. The 500MB height at 1200Z was approximated for these stations using this overlay. The dependent data were collected for the following periods: 4 January 1971 - 30 April 1971, 1 November 1971 - 30 April 1972, and 1 November 1972 - 30 April 1973. In addition, the results of [illegible] Calentine's wind study using 1200Z surface pressure gradients were compiled for the same periods. His study is explained in detail in "5th Weather Wing Local Forecast Study 73-3." His [illegible] determining wind speed and direction is given on the following page. Wind speeds are determined using this graph as follows:

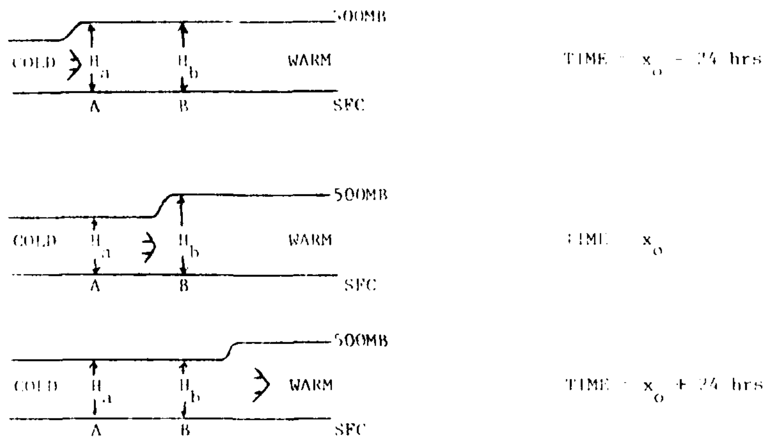
a. Calculate the 1200Z sea level pressure gradients BFL-DAG and LAX - LSV.

b. Enter these values as a coordinate on the graph.

c. If the plot falls below the solid red line, forecast winds less than twenty-five knots.

5. Independent data were gathered from daily facsimile charts and teletype surface observations. These data were gathered from 1 November 1973 to 30 April 1974.

Selected Pedictors. The 500MB height changes at VBG and OAK for the preceding twenty-four hours and the forecast height change at LSV for the next twenty-four hours were selected as primary predictors. LSV was later replaced by EDW. These predictors were selected because, ideally, they would indicate surges of cold air moving over the mountains into the desert.




Assume that point A is a coastal station (VBG or OAK) and that point B is a desert station (EDW). The time of the forecast is $x_o$. The 500MB height drop between $x_o$ - 24 hrs and $x_o$ at point A ($H'_a - H_a$) is indicative of cold air moving into that area during the past twenty-four hours. The subsequent 500MB height drop at point B between $x_o$ and $x_o$ + 24 hrs ($H''_b - H'_b$) indicates cold air moving into the desert during the next twenty-four hours. Therefore, these two factors coupled together indicate a cold air surge will occur over the mountains into the desert during the next twenty-four hours.

Using these predictors, the parameter $\Delta S$ was originally established as follows:

$\Delta S$ = (500MB height change at OAK during the past 24 hrs)

+ (500MB height change at VBG during the past 24 hrs)

+ (500MB height change at LSV forecast for the next 24 hrs)

This parameter was modified for the independent data. The forecast 500MB height change at EDW replaced the forecast 500MB height change at LSV. Therefore, $\Delta S$ is now defined as:

$\Delta S$ = (500MB height change at OAK during the past 24 hrs)

+ (500MB height change at VBG during the past 24 hrs)

+ (500MB height change at EDW forecast for the next 24 hrs)

For the dependent data the forecast 24 hr change at LSV was the actual change that occurred. For the independent data, the forecast change at EDW was estimated by the duty forecaster on that day. The actual change was not used.

EDW was later chosen to replace LSV because of its closer proximity to George AFB. Both stations are on the desert side of the mountains and, therefore, the basic forecasting principles described earlier should apply. The first year of independent data using EDW rather than LSV shows a slightly improved skill score of .483 versus .438 for the dependent data.

In addition to $\Delta S$, the results of SSgt Calentine's surface pressure gradient study at 12Z for the same day were used as an initial conditon. That is, if it indicated winds less than 25 knots, then the forecast for winds greater than 30 knots would also be NO. If the pressure gradient study indicates winds 25 knots or more, then the potential for winds greater than 30 knots is still present and, therefore, $\Delta S$ should be considered.

Scatter diagrams of $\Delta S$ vs peak wind on those days when the pressure gradient study indicated winds over 25 knots are given. From the results of the dependent study, the following criteria for forecasting winds over 30 knots were established:

If pressure gradient study indicates
- NO: Forecast NO
- YES: Calculate $\Delta S$

If $\Delta S$ is
- Greater than or equal to zero: Forecast NO
- Negative: Forecast winds greater than 30 knots

5. Presentation of Results:

DEPENDENT DATA

A. Contingency Table Summary

| OBSERVED | FORECAST | | |
|---|---|---|---|
| | Yes | No | Total |
| Yes | 49 | 30 | 79 |
| No | 52 | 338 | 390 |
| Total | 101 | 368 | 469 |

% Correct = 82.5%

Heidke Skill Score = .438

B. Post Agreement:

| OBSERVED | FORECAST | |
|---|---|---|
| | Yes | No |
| Yes | 49 | 8 |
| No | 51 | 92 |
| Total | 100 | 100 |

C. Pre-Figurance:

| OBSERVED | FORECAST | | |
|---|---|---|---|
| | Yes | No | Total |
| Yes | 62 | 38 | 100 |
| No | [illegible] | 87 | 100 |

6. Technique Evaluation: SSgt Calentine's study has been in use since 1971. By itself, it has proved to be quite accurate in forecasting winds twenty-five knots or greater. However, attempts to forecast winds over thirty knots using surface pressure gradients alone have not been nearly so successful.

a. There is one formal study currently being used to forecast winds greater than thirty knots at George AFB. It was written by SMSgt Bickett in 1965. Therefore, this study should be incorporated only if it is a significant improvement over SMSgt Bickett's wind study. As a comparison, the results of his study for 1 November 1973 - 30 April 1974 (the same period as the independent results of this study) are given below:

| OBSERVED | FORECAST | | |
|---|---|---|---|
| | Yes | No | Total |
| Yes | 17 | 12 | 29 |
| No | 19 | 83 | 102 |
| Total | 36 | 95 | 131 |

% Correct = 76.3%

Heidke Skill Score .38

b. These results reflect quite a difference in performance. The Heidke skill score and percent correct are significantly lower for SMSgt Bickett's study. In the case of "Yes" forecasts no verified, SMSgt Bickett's study was wrong nine times more often than this study. That is, the post agreement verification rate of "Yes" forecasts was on 47% verses 62% for this study.

7. Conclusion: The parameters used in this study do offer increased accuracy in forecasting winds over thirty knots. During the past season it has done significantly beeter than the Bickett study. With proper forecaster implementation, I believe this study would prove to be a valuable forecasting tool.

8. System Evaluation - October 1974 - April 1980

| OBSERVED | FORECAST | | |
|---|---|---|---|
| | Yes | No | Total |
| Yes | 61 | 56 | 117 |
| No | 83 | 604 | 687 |
| Total | 144 | 660 | 804 |

% Correct = 82.7%

Post Agreement - yes-42/no-92

Prefigurance - yes-52/no-88

Heidke Skill Score - .366

APPROVED LOCAL FORECAST STUDY

# AN OBJECTIVE TECHNIQUE FOR FORECASTING THE OCCURRENCE OF GUSTY SURFACE WINDS IN EXCESS OF 30 KNOTS AT GEORGE AFB, CALIFORNIA

BY

KENNETH W. PICKETT

TSGT, USAF

DETACHMENT 23

25TH WEATHER SQUADRON

GEORGE AFB, CALIFORNIA

MARCH 1965

An Objective Technique for Forecasting the Occurrence of Gusty Surface Winds in Excess of 30 knots at George AFB (October-April)

1. Weather event selected. Strong and gusty surface winds for the winter period (October -April).

2. Operational weather and time limits established. For the purpose of this study, any surface wind greater than 30 knots is an occurrence. The forecast period is for the 18 hour period following the receipt of 1200Z 500mb chart (0615 PST).

3. Precise statement of the problem. From data available at 0615P, to forecast the occurrence of surface winds greater than 30 knots during the 18 hour period following 0615P. This method from October - April.

4. Predictors listed.

   a. George AFB (VCV) 500mb wind direction at 1200Z.

   b. San Diego (SAN) 500mb height at 1200Z.

   c. Oakland (OAK) 500mb height at 1200Z.

   d. Surface frontal positions at 1200Z.

5. Pertinent data collected and analyzed. Two seasons (Oct-Apr) of historical weather charts for 1955-56 and 1956-57, supplemented with surface observations (WBAN 10s) for the corresponding periods, were used as the basic data for the study. The 1961-1965 data were used as an independent test of the system. The desired data were extracted from the historical maps and the WBAN 10s and assembled on work sheets. The analysis of the data was made exclusively through the use of scatter diagrams. A paper, "Some Comments on Forecasting Strong Surface Winds at George AFB" by Major Charles D. Turner is an excellent subjective treatise on this subject and the four areas of the forecast diagram (atch 2) agree very well with Major Turner's comments. Areas A and D correspond with the Tehachapi Pass winds, area B fits the Newhall Pass description quite well, and area C covers the Cajon Pass and East and Southeast Valley wind situations. A discussion of the area A, B, C, and D of the graph follows.

   a. If the plot falls in Area A, forecast YES.

   b. If the plot falls in Area B, winds of greater than 30 knots may or may not occur:

      (1) When the front is oriented NE-SW and is south of San Francisco (Ex. 2), forecast YES. (See 3 below for exception).

      (2) When the front is oriented NE SW, is as far sourth as Northern California, and there is a strong westerly flow at 500mb, forecast YES. (Ex. 1) (See 3 below for exception).

      (3) Exception to 1 and 2 above are when the fronts are quasistationary, forecast NO.

(4) When the front is well off shore (Ex #3) and the 500mb flow is nearly normal to the front, assuring rapid movement of the front, forecast YES.

(5) When the front is very close to the coast (Ex #5), forecast YES.

(6) On the day following a frontal passage, regardless of the gradient at 500mb, forecast NO. An exception to this case of the day following frontal passage is when there is a wave or occlusion off - shore (Ex #4), and the 500mb flow is nearly normal to the system, then forecast YES.

(7) With a warm front oriented E-W north of George (Ex #6), forecast NO.

c. If the plot falls in Area C, forecast NO.

d. If the plot falls in Area D, forecast YES if any of the following conditons are met:

(1) A front not undergoing frontolysis, is approaching George AFB.

(2) Cyclogenesis is occurring in Nevada with frontogenesis through Central California.

(3) A low at 500mb located in Washington, Oregon, or Idaho is forecast to move rapidly (12 hours or less) into Central or Southern Nevada, or Northwestern Arizona.

(4) A low at 500mb over Southern Nevada or Northwestern Nevada is forecast to deepen.

6. System evaluated. The season November 1961-April 1962, March 1963-April 1963 and October 1964-January 1965 were used as an independent test of the system. The following contingency tables show the results:

| | | FORECAST | | |
|---|---|---|---|---|
| O | | YES | NO | TOTAL |
| B | | | | |
| S | YES | 48 | 18 | 66 |
| E | | | | |
| R | NO | 14 | 245 | 259 |
| V | | | | |
| E | TOTAL | 62 | 263 | 325 |
| D | | | | |

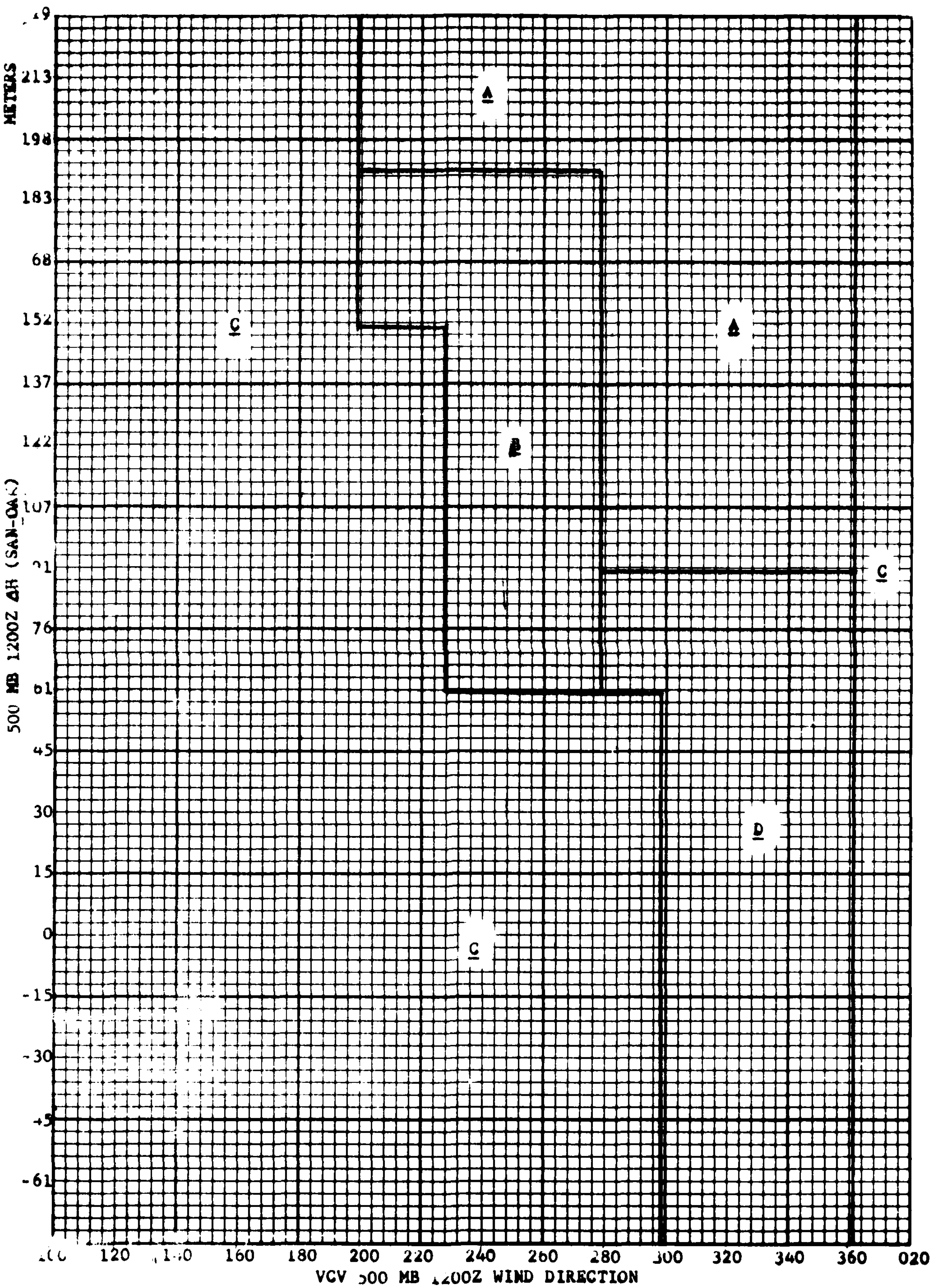
% Correct = 90
% of occurrences forecast correctly = 73
Heidke skill score = +.69

Oct 1973-Apr 1980

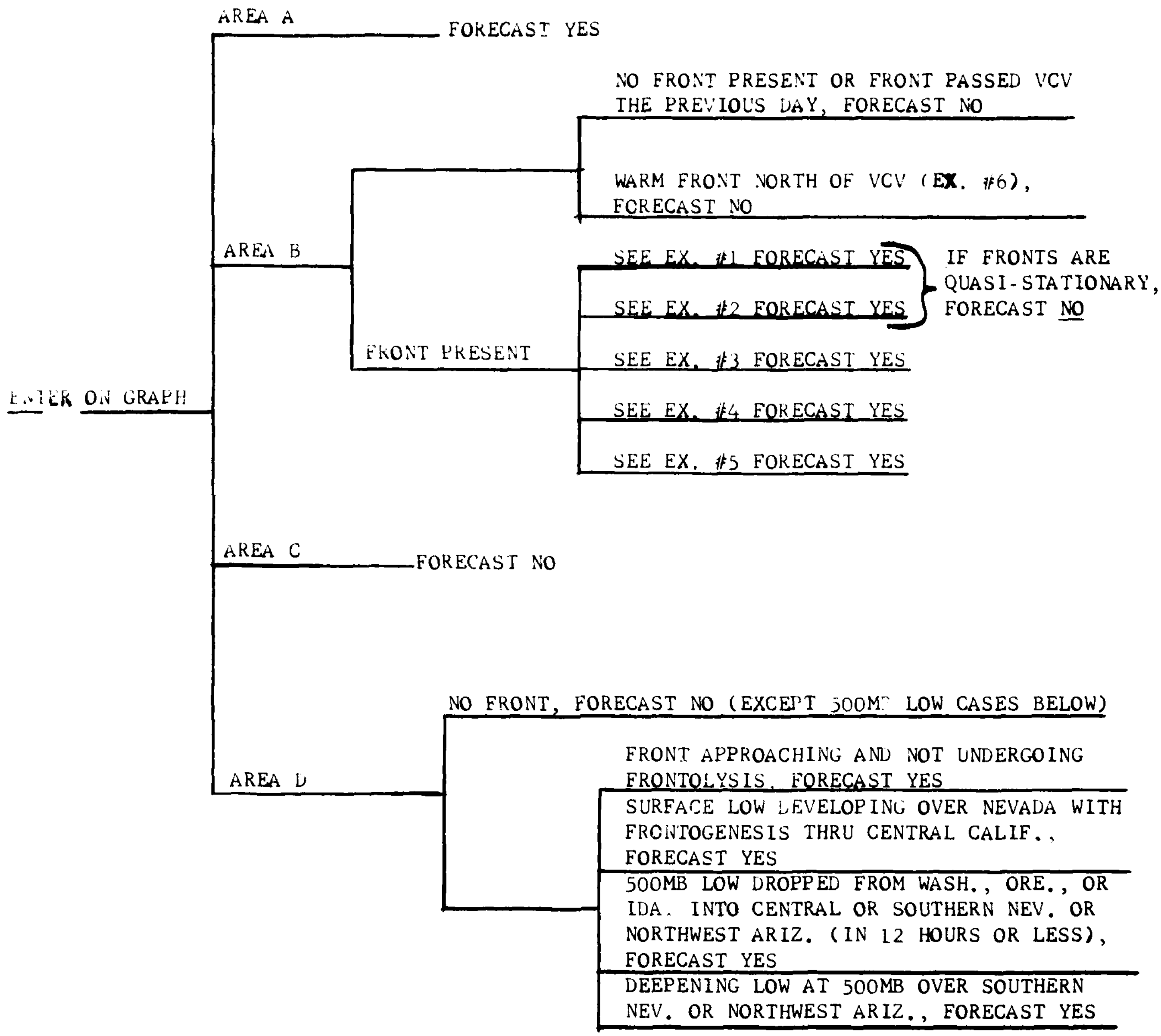
| | | FORECAST | | |
|---|---|---|---|---|
| O | | YES | NO | TOTAL |
| B | | | | |
| S | YES | 85 | 78 | 163 |
| E | | | | |
| R | NO | 120 | 779 | 899 |
| V | | | | |
| E | TOTAL | 205 | 857 | 1062 |
| D | | | | |

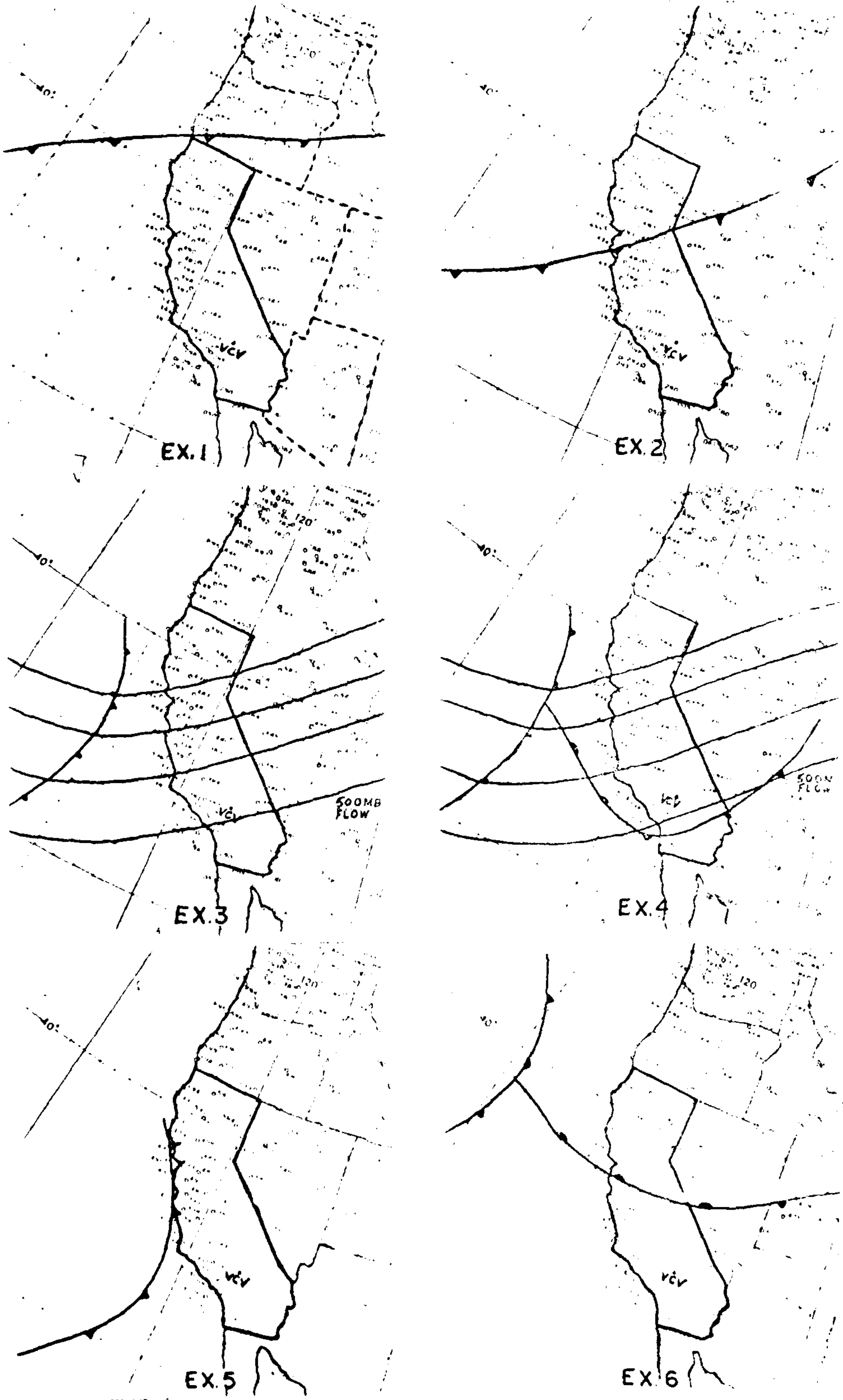
% Correct = 81.4 Prefigurance - yes-52%/no-87%

Post Agreement - yes-41%/no-91% Heidke skill score = + .351


METERS
500 MB 1200Z ΔH (SAN-OAK)
VCV 500 MB 1200Z WIND DIRECTION
213
198
183
68
152
137
122
107
91
76
61
45
30
15
0
-15
-30
-45
-61
120
160
180
200
220
240
260
280
300
320
340
360
020
A
A
B
C
C
C
D

# FLOW CHART


AREA A
FORECAST YES
NO FRONT PRESENT OR FRONT PASSED VCV
THE PREVIOUS DAY, FORECAST NO
WARM FRONT NORTH OF VCV (EX. #6),
FORECAST NO
AREA B
SEE EX. #1 FORECAST YES
SEE EX. #2 FORECAST YES
IF FRONTS ARE
QUASI-STATIONARY,
FORECAST NO
FRONT PRESENT
SEE EX. #3 FORECAST YES
SEE EX. #4 FORECAST YES
SEE EX. #5 FORECAST YES
ENTER ON GRAPH
AREA C
FORECAST NO
NO FRONT, FORECAST NO (EXCEPT 500MB LOW CASES BELOW)
AREA D
FRONT APPROACHING AND NOT UNDERGOING
FRONTOLYSIS, FORECAST YES
SURFACE LOW DEVELOPING OVER NEVADA WITH
FRONTOGENESIS THRU CENTRAL CALIF.,
FORECAST YES
500MB LOW DROPPED FROM WASH., ORE., OR
IDA. INTO CENTRAL OR SOUTHERN NEV. OR
NORTHWEST ARIZ. (IN 12 HOURS OR LESS),
FORECAST YES
DEEPENING LOW AT 500MB OVER SOUTHERN
NEV. OR NORTHWEST ARIZ., FORECAST YES


EX. 1
EX. 2
500MB FLOW
EX. 3
EX. 4
EX. 5
EX. 6

FORECASTING THUNDERSTORMS AT GEORGE AFB

By

TSgt Jerry Moore and 1Lt Robert Vogler

Detachment 1, [illegible] Weather Squadron

1. Introduction. Almost all the thunderstorms occurring in the George AFB area are of the air mass type. Nearly all occur in May, June, July and August. They are primarily a result when the Bermuda high is extended over the southern portions of the United States advecting moisture from the Gulf of Mexico to the New Mexico, Arizona, Nevada, Southern California areas. The objective of this study is to present a means of forecasting the occurrence or non-occurrence and the time of occurrence within a 10NM radius of George AFB.

2. Statement of the Problem. From the 1BW [illegible] data, forecast the time of occurrence or the non-occurrence of thunderstorms within a 10 mile radius of George AFB during the period 0900 [illegible] the same day; the forecast is to be valid during the months of May, June, July, August and September of each year.

3. Definitions.

a. Occurrence: When a thunderstorm or lightning occurrence is recorded on the George AFB AWS Form 10; when lightning or thunder is sighted or heard by any qualified weather personnel residing on the base proper at time of occurrence, or PIREP indicates within 10NM VCY.

b. K-Index, Tc, Total Totals, Average RH, SFC 500MB (%). See AWSM 105-12[illegible] for definitions.

4. Data Analysis Discussion. Thunderstorms occur in an unstable air mass when sufficient moisture [illegible] within the air mass and a lifting mechanism lifts a parcel to a point where it is warmer than its surroundings from which point the parcel continues ascent until in equilibrium [illegible] [illegible] surroundings.

[illegible] daily, analysis of the Edwards AFB sounding has been a required procedure. Several attempts have been made in the past to arrive at some correlation of thunderstorm occurrences, [illegible] but non-statistically. In this paper, values derived from average relative humidity (SFC-500MB), K-Index, critical temperature and total were statistically used.

b. Initially, a scattergram of occurrences or non-occurrences was plotted using average relative humidity (SFC-500MB), K-Index, convective temperature and total totals, each parameter by itself. Poor correlations resulted and this method of approach was abandoned.

c. Next, RH vs Tc was computed, Graph #1. Correlation here was fair, but not as good as we had hoped. So, in this approach, too, was abandoned.

d. Next, Tc vs K, Graph #2, was computed, with almost the same results.

c. Finally, it was decided to combine the four parameters, TC vs RH and TT vs K, on one graph, (#3). A satisfactory degree of correlation resulted with test data. All Edwards AFB sounding data available for 1969/70/71/72/73/74 (1 Jun) showing actual thunderstorm occurrence at George AFB was used as dependent data.

5. Presentation of Results: To standardize forecast preparation procedures, proceed as follows, using the 1000Z Edwards (EDW) sounding and the work sheet.

a. Compute the EDW SFC - 500MB RH factor, compute the K index, Total Totals, and Tc values. Methods of computations are located in AWSM 105-124.

b. Using the George AFB temperature curves as a guide, construct a temperature curve for the day. You now have a close approximation of the hourly (LST) temperature values. If the constructed temperature curve values indicate attainment within three (3) degrees of the Tc value, use the time of attainment as guide in timing commencement of thunderstorms. The temperature curves present a statistical evaluation of hourly mean values as well as one standard deviation above and below the mean.

6. Technique Evaluation. The graphical regression technique was employed in this study. Here we were able to take four different variables and plot them all together in one original graph. This final graph (#3) gave us a function of all four variables. In graph #1 we plotted the RH vs Tc and drew isopleths of 10% intervals on either side of the original 50% line, which ideally divided the graph into one side of actual occurrences, and one side of non-occurrences. The skill scores for these graphs are in Table #1. From graph #1 we obtained a value based on RH vs Tc for each individual event. This allowed us to have a value of the function Tc/RH. On graph #2 the same process was used to come up with a function for TT vs K. We then plotted the values of the two functions of all four (4) variables. This incorporates all four (4) variables into one single [illegible]. Based on this percent figure, we would have a YES/NO decision, with 50% being the deciding factor. That is, greater than or equal to 50% we would forecast YES occurrence, and less than 50% a NO occurrence. Generally, the key numbers that indicated a strong chance of occurrence were a Tc/RH value of greater than 50%, combined with TT/K value of 36%. As can be seen on graph #1 and #2, there are no individual key numbers in any of the categories, but together, we get some key figures which have a skill score of .77 (Table #1).

a. A weakness of the technique could be arriving at an incorrect forecast due to difference between moisture content of the air mass at Edwards and the air mass within 10 mile radius of George AFB. This difference could alter some or all of the parameters at times. Also, actual TSTMs are relatively rare at George AFB (7 per year).

b. A complete, concise analysis of the Edwards sounding is basic to the entire procedure. There is no room for approximate values or individual assumptions that alter the values obtained from the analysis.

c. Until some means of measuring difference in moisture content (SFC-500MB) between air masses at George and Edwards is available, only subjective evaluations of the differences can be applied to this study.

7. Conclusion. This study should be used daily from 1 May through 30 September of each year. It works well in providing a YES/NO forecast. There are no new concepts in this study.

8. System Evaluation/May 1975-Sep 1979

| OBSERVED | FORECAST YES | FORECAST NO | FORECAST TOTAL |
|---|---|---|---|
| YES | 20 | 11 | 31 |
| NO | 49 | 413 | 462 |
| TOTAL | 69 | 424 | 493 |

% Correct = 87.8

Post Agreement - YES 29 NO 97

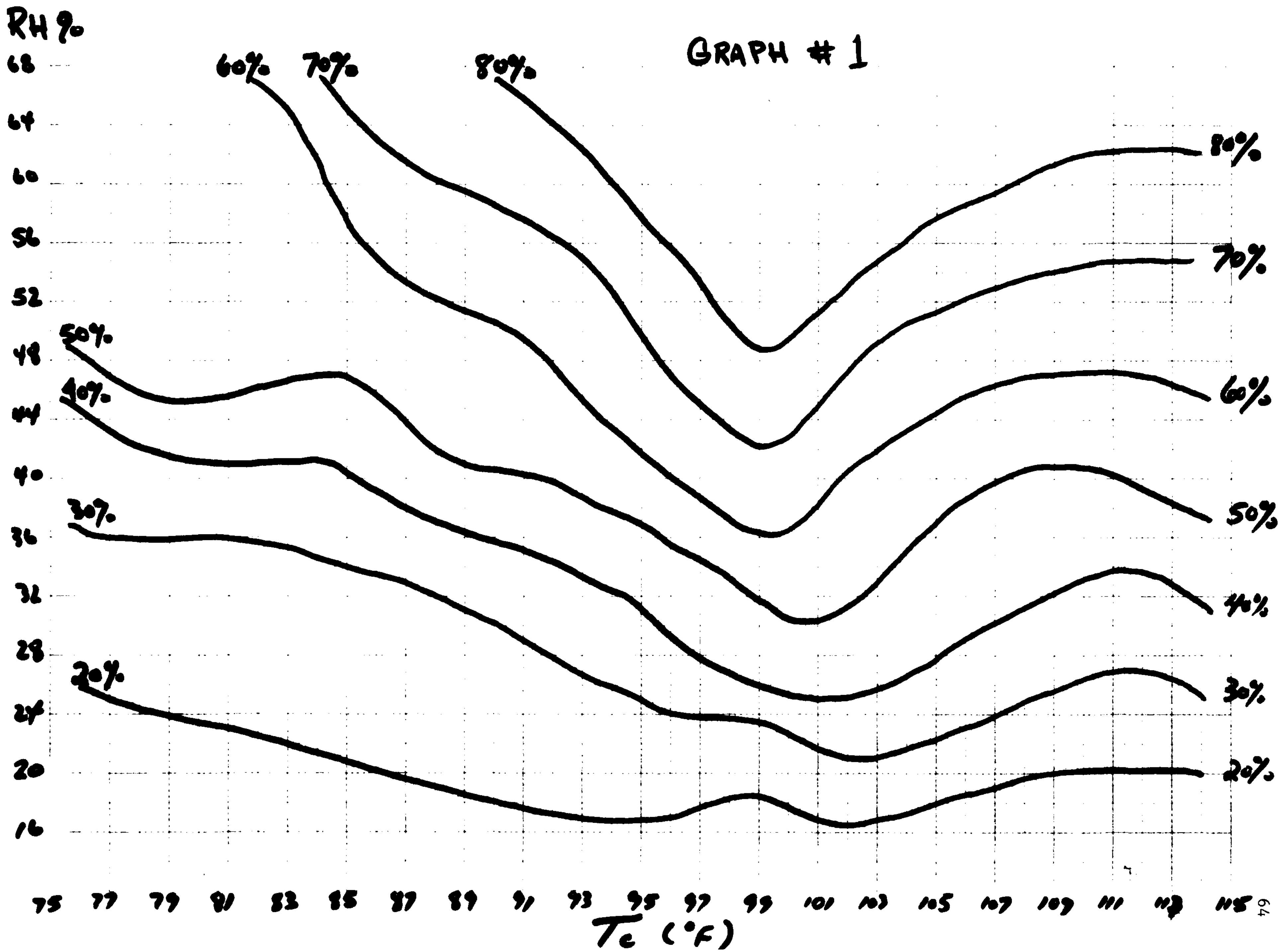
Prefigurance - YES 65 NO 89

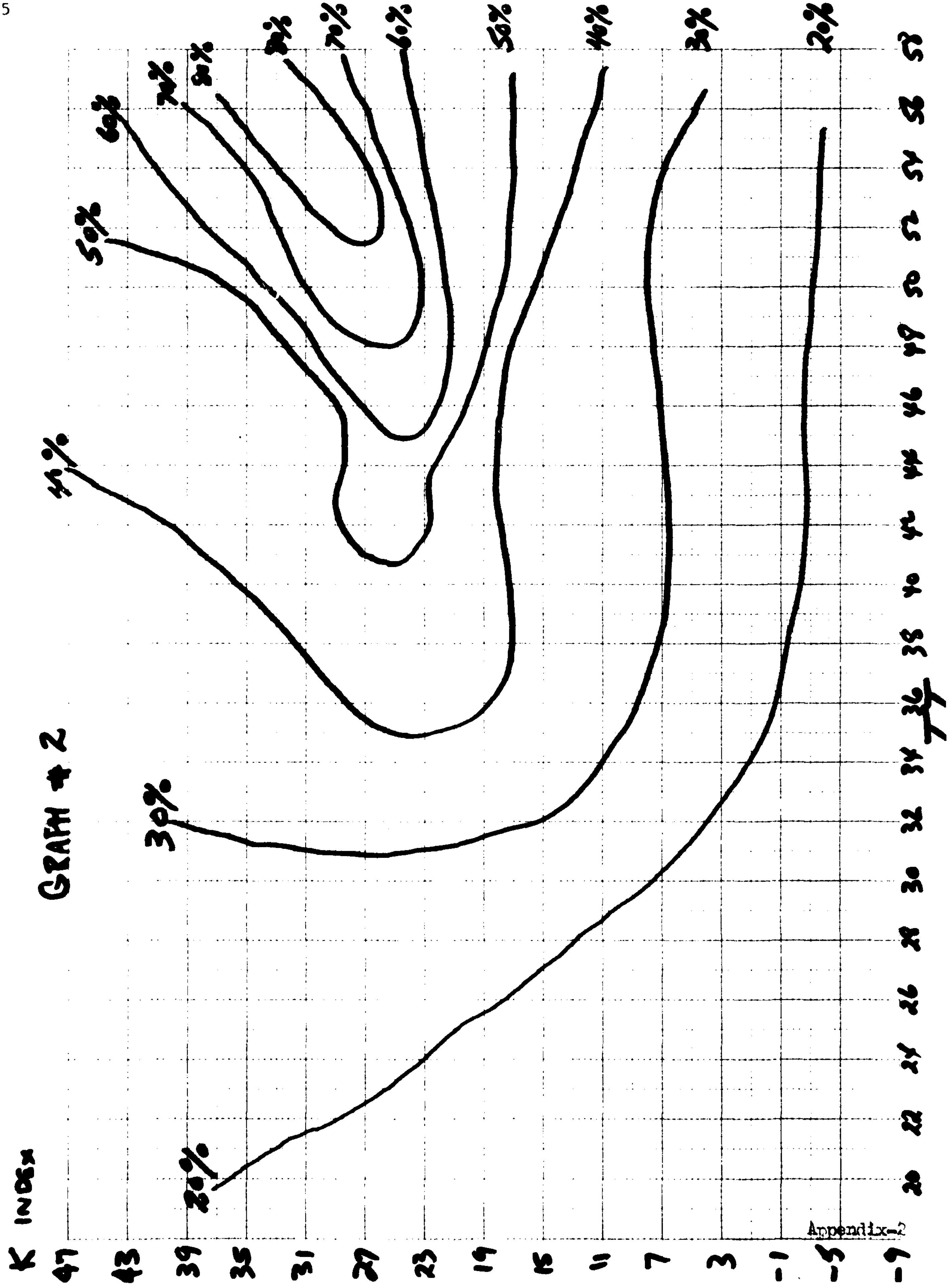
Heidke Skill Score = .343

TABLE #1 HEIKE SKILL SCORE AT EACH % LEVEL

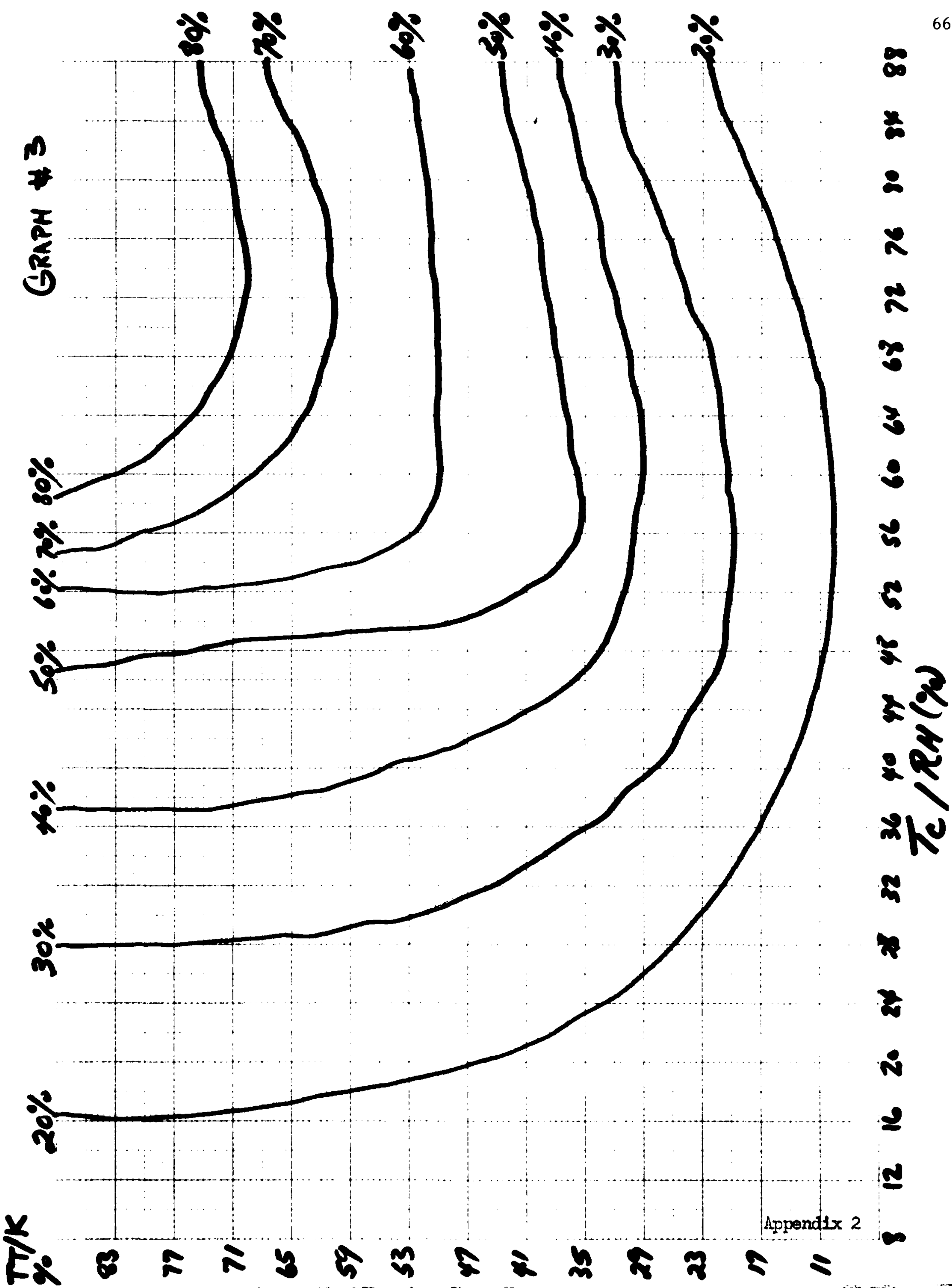
The following data indicates the skill score (based on 1 as a perfect score) computed at each percent interval indicating how well the data would be in forecasting an occurrence. Example: If the 40% level was used to forecast with, it would mean that a final value of 40% or more would be a YES forecast and a less than 40% value a NO forecast. The skill at this level is .588.

| GRAPH #1 (Te v RH) | GRAPH #2 (TT v KS) | GRAPH #3 (Te/RH v TT/K) |
|---|---|---|
| 80% = .097 | = .219 | = .174 |
| 70% = .266 | = .412 | = .364 |
| 60% = .441 | = .589 | = .536 |
| 50% = .737 | = .737 | = .773 |
| 40% = .500 | = .590 | = .588 |
| 30% = .341 | = .289 | = .447 |
| 20% = .137 | = .150 | = .264 |
| 10% .000 | = .000 | = .000 |


GRAPH # 1
RH %
68
64
60
56
52
48
44
40
36
32
28
24
20
16
75
77
79
81
83
85
87
89
91
93
95
97
99
101
103
105
107
109
111
113
115
$T_c$ (°F)
60%
70%
80%
50%
40%
30%
20%
80%
70%
60%
50%
40%
30%
20%


GRAPH # 2
K INDEX
47
43
39
35
31
27
23
19
15
11
7
3
-1
-5
-9
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
20%
30%
40%
50%
60%
70%
80%

Appendix-2


GRAPH #3
TT/K %
Tc/RH (%)
20%
30%
40%
50%
60%
70%
80%
83 77 71 65 59 53 47 41 35 29 23 17 11
8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 76 80 84 88

Appendix 2

FORECASTING GUIDE FOR CUDDEBACK AIR TO GROUND GUNNERY RANGE

*Located at 35°16' North Latitude; 117°26' West Longitude* (Fig A6-1), Cuddeback AGGR serves as an [illegible] practice bombing range. The range itself is [illegible] 2835 ft [illegible] adjacent to Cuddeback dry lake in the Mojave Desert.

While the Gunnery Range experiences much the same weather as George AFB, topographic features have a distinct bearing on the local synoptic conditions. Mountain passes channel the wind and these strong winds through the passes initiate dust storms off the dry lake bed. In addition, the mountainous terrian induces orographic uplifting with result of cumulus build-ups creating thunderstorms in the summer with sufficient convection, and producing snow showers/rain showers during the winter months with frontal systems or troughing aloft. Often this weather will occur as a local phenomenon with the skies clear at other southern California stations such as George. The two operationally significant forecast problems at Cuddeback AGGR are strong winds and low visibilities due to blowing dust and blowing sand.

Restricted visibilities result most often from strong surface winds channeled through three mountain passes. Broken chains of mountains [illegible] encircle Cuddeback with [illegible] passes to the North and West and a smaller pass to the Southwest (Fig A6-1).

The largest pass to the west (260-290 deg) leaves Cuddeback open to blowing dust and sand picked up from the dry lake bed running parallel to the pass. West winds of ten knots may at times, be sufficent to reduce the prevailing visibility to ten miles or less. Winds of 25 knots or greater for several consecutive hours will restrict visibilities down to [illegible] miles or less.

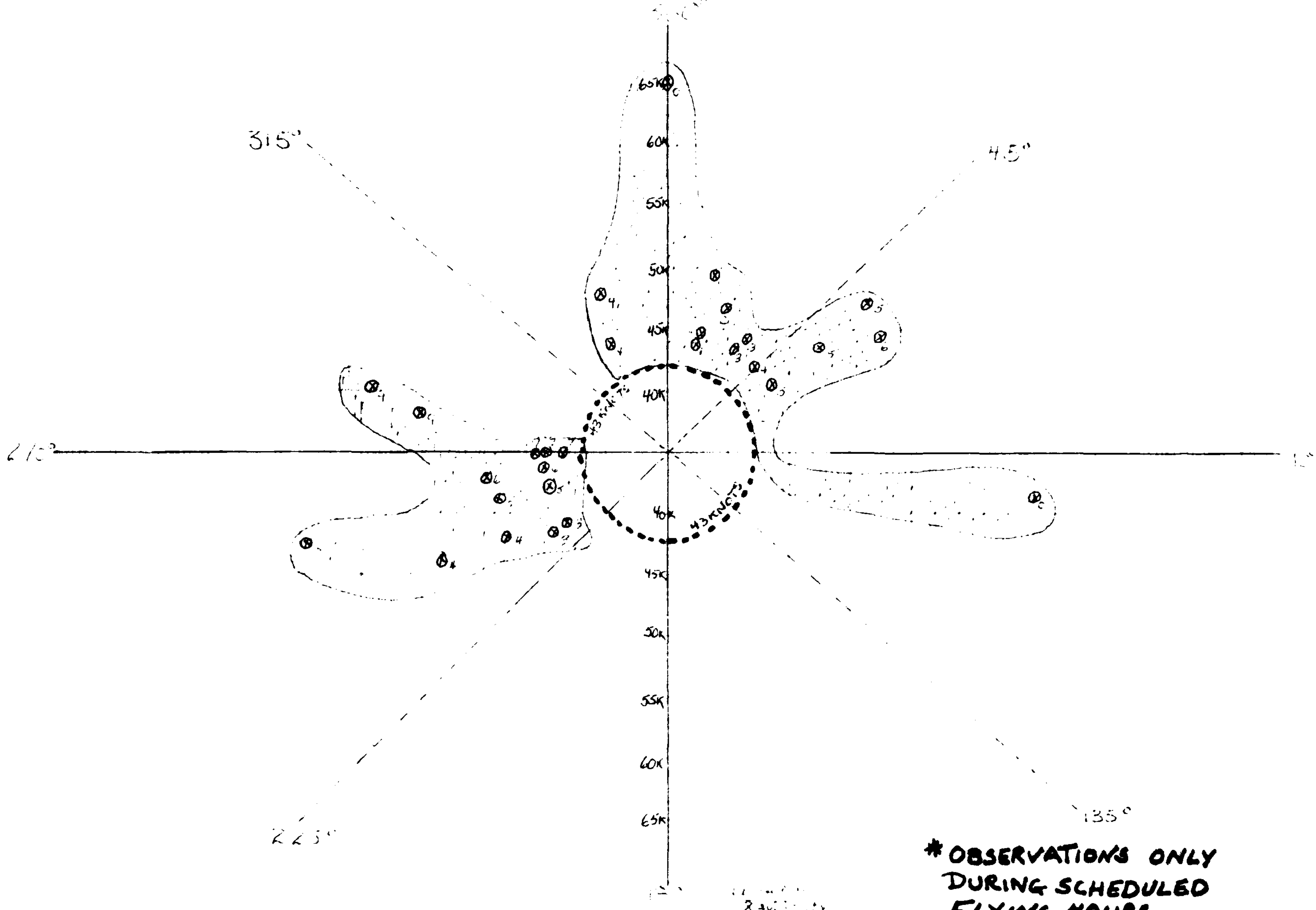
[illegible], narrower pass to the southwest (230 deg) will restrict visibilities on the range due to a significant channeling effect, although not as frequently as the other two passes. Winds upwards of 30 knots from the southwest will generally reduce visibilities to around five miles and sometimes lower.

Figure A6-2 illustrates how the passes channel the strong winds onto the range, while the chains of mountains form effective barriers. This graph depicts all observed winds with a velocity that equals or exceeds Weather Warning criteria at Cuddeback (≥ 40 kts) from 1967 through 1971. Since the range itself has limited weather observation capability, usually during the flying week, the data has a limited basis. Yet, it offers perspective over a 4 year period as a trend for forecasting strong winds during the hours of flying at the range.

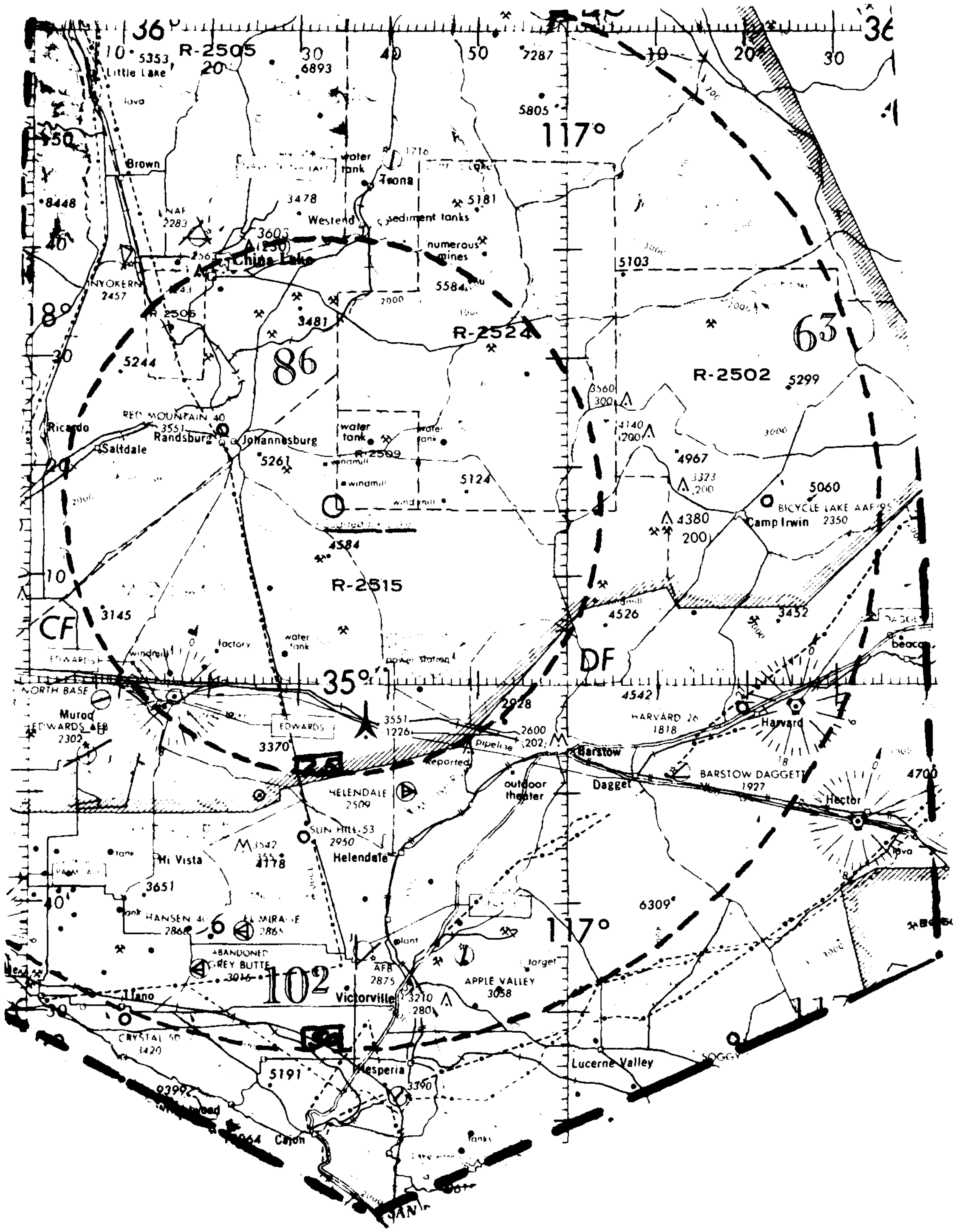
Winds greater than or equal to 40 knots rarelyblow from southeast through southwest as evidenced on the graph. Here the mountains maintain a subatantial barrier against gusty winds. The strongest winds blow from the north, west, and east due to the orientation of the passes.

Hence, a pressure gradient force in conjunction with th[illegible] through the passes will produce the strongest winds usually in the winter [illegible] result of a cold frontal system or trough aloft.

# WINDS ≥43KTS AT CUDDEBACK DRY LAKE 1967-1972*




*OBSERVATIONS ONLY DURING SCHEDULED FLYING HOURS.


R-2505
Little Lake
Brown
China Lake
Westend
Trona
INYOKERN
R-2506
R-2524
86
63
R-2502
RED MOUNTAIN
Randsburg
Johannesburg
Saltdale
Ricardo
R-2509
R-2515
BICYCLE LAKE AAF
Camp Irwin
CF
DF
35°
117°
NORTH BASE
Muroc
EDWARDS AFB
EDWARDS
Barstow
Dagget
BARSTOW DAGGETT
HARVARD
Harvard
Hector
HELENDALE
Helendale
Hi Vista
HANSEN
EL MIRAGE
ABANDONED GREY BUTTE
102
Victorville
APPLE VALLEY
Llano
CRYSTAL
Hesperia
Lucerne Valley
Cajon

DATE
ILMED

-8